The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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Need for More Liberal Endowment

AT the present time, when governments and people are constrained to exercise the utmost economy in very many ways, there is great danger lest we should in an unguarded moment be prevailed on to "economise" on some of the things with regard to which even prodigality might eventually turn out to be the truest economy both for the State and its people. To-day it is evident that science is being crippled in this country for want of funds; but it is certain that the starvation of science is false economy if only we could take the long view, and remember some of the things which we were supposed to have learned during the war. Both our older and newer universities have fairly well grasped the position; and, in spite of the need for fostering their resources, they have continued to provide as liberally as possible for the carrying on of pure chemical research by staffing their colleges with men who will add lustre to the university itself and increase the sum of human knowledge. In that borderland, however, between pure chemistry and the chemical industry there is need in this country for the wherewithal to prosecute research for the direct betterment of industry. It is necessary that we obtain as soon as possible data which will enable us to set up here new industries of first importance, and so prevent the exploitation in other countries of results achieved by British workers. In the past we have been content to see some of our best work taken up by others and thereby we have lost more than one valuable industry which has had to be recovered at enormous cost in a time of great stress.

At the moment there is great activity amongst scientific workers in connection with the many problems of nitrogen fixation. Different processes have their own advocates, and it is difficult to obtain a true perspective of the commercial advantages and disadvantages of various methods. Most of all is it necessary for us to decide which particular form of process will be most likely to suit the conditions of our own country. Developments now taking place show that whatever may be the precise value of the older processes, it is probable that we have not yet arrived at finality as to method, and the work of Professor Bone, which we referred to last week, on the explosion of carbon monoxide and oxygen in the presence of nitrogen, whereby the latter becomes "activated" and combines with the oxygen, forming nitric acid, is an instance of what we have in mind.

Years ago the British Science Guild was formed with a view to proclaiming the urgent necessity for more generous State recognition of science. During the war the nation was brought to realise how slow we had been in the past to help our experimental workers in science, even when the safety of the country depended on it. The lesson we then learned, however, is already in danger of being forgotten, and it rests with the British Science Guild, the Royal Society, or some other influential body, to call the attention of the Government to the danger incurred by the loss of valuable time. Another subject of pressing importance is that of the cheap production of alcohol by biological processes from starch-containing materials or from cellulose. Much work of great promise has been done on these lines; but it should be realised that it is highly improbable we shall ever be able to spare starch on a sufficiently large scale to provide alcohol for fuel and all other purposes. Starch is valuable as food, and this probably will always be its chief use. But in cellulose we have material which is at present largely going to waste, and concentrated efforts to solve this problem from the scientific and economic standpoints would soon be rewarded. We think, therefore, that immediate assistance should be given to Mr. Chaston Chapman's project for an Institute for Industrial Micro-Biological Research, preferably provided and financed generously by the State. We have realised in recent years that what the chemist is able to do in laboratory and works by the aid of strong reagents at high temperatures and pressures, the lowly organism can perform without any of these agencies and under conditions which are readily capable of control. In this way Germany at war was able to produce quantities of glycerin while we laboriously

made it by splitting valuable fats which could have been used for other purposes.

The whole question of fuel, again, is in an unsatisfactory state. Our fuels are not inexhaustible, and with our present wasteful methods we shall at no very distant date be forced by the logic of circumstances to do something to solve problems that threaten to overwhelm us in the future. The Fuel Research Board is a step in the right direction; but many consider that its activities are limited and altogether too restricted in scope. Something should quickly be done to get a larger view of all such pressing problems. Many of them urgently await solution, and if we continue to neglect the solemn warnings given from all sides, we must expect to see other countries reaping where we have sown, increasing their material wealth in times of peace, and promoting their own readiness in the event of war.

Business Conditions in the United States

In a communication just received by The Chemical Age from a well-informed source in New York, an interesting glimpse is given of the present state of commercial feeling among American business men. "The usual development of business," our informant states, "which has been going on for many months, has experienced what would seem to be a few warning symptoms in the last week. The New York stock market has been sagging little by little from time to time, which is generally considered a pretty correct barometer of conditions. We calculate that the stock market anticipates general business conditions six to eight months. This little warning has taken a serious hold on quite a few people. Another indication of future conditions has shown up in the fact that orders for steel have fallen off very materially in the last week or two. Orders are scarcely 50 per cent. of deliveries at the present time. This morning's papers have told how approximately sixty million dollars' worth of new buildings projected, and on which work was expected to start at once, have been held up indefinitely, due to the high cost of materials and the generally unsatisfactory condition of labour. I had a report from a commercial man representing one of our largest groups of textile mills, who said that buying has slowed up very materially throughout all parts of the country in the last couple of weeks. These examples are cited to indicate just how necessary it is to watch everything at the present time, and how uncertain we feel while in the midst of what normally would be considered great prosperity.

"The automobile industry," he continues, "has been going ahead with tremendous leaps. In April we produced 364,000 vehicles, as compared with 346,000 in March. This is nearly 40 per cent. in advance of a year ago. For the year ending April 30 we produced 3,208,000 vehicles, which is by far the largest production we have had in any twelvemonth period. Ford is to-day producing 6,000 vehicles per day, and other manufacturers of low-priced vehicles are producing at record-breaking figures. There has, however, been a perceptible falling off in the demand for high-priced cars. At times we just cannot figure out where all of the cars are going to, but with plasterers being paid $16 per day, and in some sections as high as $30 per day, we see a possible outlet for many cars. I pass between my home and the railroad station several new homes in the course of construction, and in front of them is a line of motor vehicles owned by the carpenters and other workmen. A year ago you did not see this sight, which convinces me that practically every workman goes to work in his motor car.

"It is pretty hard for us just to accept such things without a little feeling of where it will all end. Perhaps we are getting a little old-fashioned and not quite keeping in step with the development of the world. However, when we see big interests feeling quite uncertain, and see business reactions setting in as I have mentioned, it is time to make a very careful survey of conditions."

Oil and the Sulphur Problem

It is some considerable time since we made any observations on the prospects of those enterprises which owe their origin to praiseworthy, if over-sanguine, individuals who have been seeking to develop a home-produced oil industry. Our comments in the past can scarcely have brought balm to investors in these schemes, and while we were always ready to recognise the immense national importance of rendering ourselves independent of imported oil, we were compelled to express the opinion that Nature, though she had been bountiful in the way of endowing us with coal, had appeared to have almost entirely neglected us so far as natural oil sources are concerned. We can remember more than three years ago drawing the attention of our readers to the fact that in many instances those who were interested in the search for oil over here had frankly stated that until very much further knowledge of the deposits was obtained no definite opinion could be given as to the commercial prospects of the ventures. The shares of the undertakings concerned then stood at many times their par value, their high price being based on future prospects and an exaggerated faith in theoretical conceptions turning out as anticipated. Now only a few days ago we find the chairman of one of the principal of these undertakings, English Oilfields, Ltd., pointing out that, notwithstanding the many glowing statements which have been made, the problems of retorting, refining and desulphurising, which had occupied some six and a half years, were still unsolved when the reconstituted board got to work. Perhaps most significant of all is the information that, in spite of all statements and claims made as to the possibility of commercially desulphurising Norfolk shale oil, not one of the many attempts had proved successful.

In view of this striking admission one is prompted to refer back to the expression of opinion as to the stumbling block of sulphur which was given in 1920 by Sir John Gregory. Attention was drawn to the fact that the shales in the King's Lynn area contain 6 per cent. of sulphur, and that while the elimination of sulphur from the oil distilled from the shales was feasible as a laboratory process, there appeared to be no known commercial process for purification. Efforts to discover such a process were made in Glasgow over fifty years ago, and since then the attempt has been repeatedly renewed, and it now seems as though ultimate success must almost be despaired of. Even

though the problem of desulphurisation defies solution, however, it does not necessarily mean that the oil is unmarketable, and it is to be noted that the undertaking referred to above is now finding possible uses for oil where sulphur, instead of being a disadvantage, is on the contrary an advantage.

Louis Pasteur

DURING the past fortnight celebrations have been held in Paris and in Strasbourg in connection with the centenary of Pasteur, delegates having been sent from all parts of the world. It is not too much to say that these celebrations are in recognition of the initiation of work which has brought about as great a change in the aspect of human life as any invention or discovery of modern times. Louis Pasteur was born in December, 1822, the son of a soldier in the Napoleonic wars. His early life, though studious, was undistinguished, except by a leaning towards art and a gift for drawing in chalk. His first scientific interests were in the phenomena of light and crystals, and it was thus he discovered that there was but one form of tartaric acid which could undergo fermentation. He was led on naturally from this to the investigation of the nature of fermentation, and became thus pledged to the world of the "infinitely small." To examine further the phenomenon, Pasteur devoted a period to work in the wine-growing districts of France and incidentally solved many difficulties of the wine-growers. He next traced a "blight" affecting the silk producing industry to the activities of a parasite of the silkworm moth. From these researches he gradually developed the modern theories of fermentation, putrefaction and decay, and it was directly owing to this work that Lister, the great British surgeon, was enabled to initiate the principle of antiseptic surgery. The investigation of the cause of disease became now Pasteur's chief aim, and we may mention his conquest of anthrax and hydrophobia as outstanding points. Pasteur died at the age of seventy-three, the recognised founder of bacteriology and bio-chemistry.

By-Product Coking Developments

WE have just received from the publishers (Ernest Benn, Ltd.) a copy of the new edition of the late Mr. Stanley Cooper's well-known book on "By-Product Coking." The new volume, which has been extensively revised by Mr. Ernest Myers, manager of the Coking Department of the Shelton Iron, Steel and Coke Co., will be reviewed in our columns in the near future, but on glancing through it we are struck by one or two expressions of opinion relating to developments in the coking industry which indicate that we have by no means approached finality so far as coking methods and plant are concerned. There would seem, too, to be some considerable divergence of opinion between this and other countries as to the limit of size of coal charge, and upon that very important factor the width of the oven. This latter has necessarily some considerable influence upon the proportion of volatile matter remaining in the coke, and in this country it has been our custom to reduce volatile matter to a minimum. Lately, however, a great deal of research has been carried out in the United States with the object of determining the essential features of oven design which will best yield a coke of such structure that it will be possible to effect substantial improvements in the economy of this fuel in the blast furnace, and permit of the furnaces being driven at a greater rate.

The American work seems to indicate that overcoked material is not nearly so good as coke containing a higher proportion of volatile matter than is customary in English practice. Hence the evolution of the narrow oven and rapid coking. This is only one of the new phases through which the industry is passing, and when one considers the fact that as a coal consumer the by-product coking industry makes a somewhat greater demand upon our coal resources than does, for example, the towns' gas industry, it is a matter for encouragement to find that in all directions attempts are being made to increase efficiency.

Points from Our News Pages

The first portion is published of an article by Mr. F. M. Potter on "Methods of Costing in Chemical Works" (p. 588).

An article is contributed by a Works Chemist on "Stainless Steel in the Chemical Industry" (p. 590).

A paper read recently in America by Dr. Risteen dealt with "The Handling of Compressed Gases," and certain sections of this are published (p. 592).

A paper was read recently before the Coke Oven Managers' Association (Northern Section) dealing with certain points in connection with "Benzol Recovery" (p. 593).

Trade has been more active this week according to our London Market Report, and fair business has resulted (p. 601).

According to our Scottish Market Report, business during the past week has been more satisfactory (p. 604).

Book Received

THEORETICAL CHEMISTRY. By Professor Walter Nernst. London: Macmillan and Co., Ltd. Pp. 922. 28s.

The Calendar

June 1 to 14	Sixth International Mining Exhibition. 11 a.m. to 8 p.m. daily.	Royal Agricultural Hall, London, N.
4	Society of Chemical Industry (London Section): "The Stream-Line Filter." Dr. H. S. Hele-Shaw. 8 p.m.	Burlington House, Piccadilly, W.1.
6, 8 and 12	University of London: "The Structure and Behaviour of the Molecule." Professor Gilbert N. Lewis. Lecture. i.—The Structure of the Molecule (Atomic and Molecular Statics). ii.—The Colour of Substances. iii.—The Sources of Chemical Affinity (Atomic and Molecular Dynamics). 5 p.m.	University College, Gower Street, London, W.C.1.
7	Royal Institution of Great Britain: "The Nature of Enzyme Action." Sir William M. Bayliss. (Lecture II.) 3 p.m.	Albemarle Street, Piccadilly, W.1.
7	Chemical Society: Ordinary Scientific Meeting. 8 p.m.	Burlington House, Piccadilly, W.1.
8	Institution of Chemical Engineers: First Annual Corporate Meeting.	Engineers' Club, 39, Coventry Street, London, W.1.
20 to 23	Society of Chemical Industry: Annual Meeting.	Cambridge.

Methods of Costing in Chemical Works.—I.

By F. M. Potter, F.I.C.

In a recent address to the chemical students of the Northern Polytechnic Institute, London, the author dealt with the important question of costing in chemical manufacture, and this address forms the basis of the following article. The concluding section will be given next week.

THE subject of chemical works costs is one of interest not only to works chemists but also to the research worker engaged upon an investigation that he hopes will, in due time, find an industrial application. The great difficulty of the junior chemist in the past has been to gain some acquaintance with actual works costs, in order to compare them with his own estimates and to determine how far it is necessary to adopt a factor of safety in order to cover the ratio of the plant figure—including a number of uncertain quantities, such as forced time delays, plant losses of materials, overhead charges, share of repair shops charges, etc.—to the theoretical calculation. During the war Mr. Quinan, the technical chief of the Factories Branch of the Ministry of Munitions, insisted that the chemical and engineering staffs of the various factories should study the monthly costs returns, not only of their own works, but also of other factories engaged upon the production of the same or similar products. The costs of manufacture of a given product at every factory engaged in its production were carefully scheduled item by item, and corresponding graphs constructed. Managers and departmental heads were then called upon to explain variations from the best (or from the average) figures. In this way much valuable data was assembled, and by the breadth of vision of the Department of Explosives' Supply, Ministry of Munitions, it has been decided to publish these figures for the benefit of chemical industry in general, the work being completed under the excellent editorship of Mr. W. MacNab, C.B.E., F.I.C. Two volumes have been published and can be seen in the Chemical Society's Library.

The published costs cover the manufacture of a number of different types of products, involving the corresponding various works operations. By study of the figures the student will gain an insight into the method of compiling costs, and of their systematic use for their improvement. I would venture to suggest that the reports are incomplete in one respect; they provide no figures for the capital expenditure at the various factories, and do not indicate the particular local advantages or disadvantages peculiar to some of the factories. I desire to acknowledge my indebtedness to these reports for many of the figures quoted in this paper.

Correct Use of Costs Returns

It is not my purpose to deal with the method of compiling costs, but to make some general remarks upon the correct use of costs returns by the chemist. For the purpose of illustrating some of the points I shall assume that we are manufacturers of nitric acid from Chile saltpetre and sulphuric acid, a process that follows closely the method of preparation used in the elementary laboratory. I shall also assume that the works possesses an organised costs department, which issues regularly a statement of the cost of manufacture covering the previous monthly period. This statement should be according to the form shown in diagram 1, and gives the expenditure under headings of raw materials—subdivided according to the process—wages, fuel, steam, power, repairs and renewals, "on cost" (share of general factory expenditure), etc. The chemist, having received a number of these returns, will have graphed them in such a way as to indicate at a glance the upward or downward tendency of each item. He is now in possession of food for reflection in the quieter period after normal working hours, when the usual sequence of works worries no longer disturb his thoughts.

The chemist will proceed to study the matter mainly in the light of his own particular duties. The relation of the actual cost of production to the existing market price, while of interest to him, concerns more directly the higher management and the sales department. His duty is to manufacture the product at the lowest possible figure—whatever the margin of profit—and to introduce alterations and improvements in order to attain this result. He must endeavour to achieve the economic use of materials and labour, and the reduction of the burden of overhead charges by obtaining the maximum output under efficient working conditions. He must give some attention to the use of by-products, which include waste heat and water. His attention will therefore be given, in the first place, to the item that accounts for the greatest fraction of the expenditure.

For instance, in the case of nitric acid employing war-time figures, 84 per cent. of the cost is accounted for under the heading of raw materials, and this again is mainly due to the cost of nitrate. It is apparent, therefore, that herein lies the greatest opportunity to effect economies, since a 5 per cent. improvement in the materials use figure will yield a saving of £2·25 as against £0·22 for a corresponding reduction in the labour use figure. The opportunity may be more apparent than real, but I am pursuing the obvious method of tackling the problem; the contrary factors will come to light as we develop the argument. Thus the first step is to compare the plant use figure with the theoretical figures showing the use figure as a percentage yield. In the case illustrated, the nitrate used is shown as of the order of 1·42 to 1·50 tons per ton 100 per cent. nitric acid produced, the nitrate also being calculated for obvious reasons on the 100 per cent. basis. These figures correspond to a 90 to 95 per cent. yield, and the next question naturally is the disposal of this 5 to 10 per cent. loss, and the possibilities of its reduction. The solution of this question will require examination of the literature of the subject, and experimental work, such as the investigation of the various sources of leakage, such as gaseous and liquid effluents, solid by-products, etc.

Gaseous Losses

In the case under consideration gaseous losses will come under two main headings—the loss of oxides of nitrogen at the exit of the absorber towers dependent upon the efficiency of this section of the plant, and losses due to leaky joints at the retorts and throughout the condenser system. The first may call for increased absorption capacity, and hence capital expenditure on new plant, or it may be found that better regulation of the return flows of dilute acid through the towers and better temperature regulation may yield some improvement. The latter points, if practicable, should be applied at once. Their application entails probably little or no capital expenditure.

Briefly, the first step is to get the existing plant into the best possible working order. Liquid losses will be mainly due to leakages, and it is surprising how great may be the effect of a small drip when going continuously for the 24 hours of the day. At the Litherland and Penrhyn factories the following method was adopted for bringing home to the personnel of the factories the importance of reducing leaks. In a suitable prominent position in the works a flanged pipe was connected to the water main and closed by a blank flange so that the joint allowed water to pass at a standard rate, which was such that a continuous stream was just formed. A vessel of 6 in. by 3 in. diameter, which was filled in one minute, was placed under the leak, and was used for the daily standardisation. The joint was adjusted daily, so that the rate of leakage remained constant. Over the pipe a large notice was placed, and was worded somewhat as follows:—

THIS LEAK CORRESPONDS TO

224 GALLS. PER 24 HOURS.

EQUIVALENT VALUE AS NITRIC ACID, £21,000 PER ANNUM.

VALUE AS SULPHURIC ACID, £4,400 PER ANNUM.

THE ANNUAL LOSS OF NITRIC ACID CORRESPONDS TO 820 TONS NITRATE TO BE BROUGHT BY SEA (HALF A SHIP'S CARGO).

The latter point being a reference to the submarine menace.

The effect was that much greater attention was paid to small leaks which previously had not attracted serious attention, and after a short period the standard leak was reduced to one-fifth the above rate. Another method of checking liquid losses and also of soluble solids is to institute regular analyses of the main works effluent, and also of all outlets of sewage and surface water, determining, say twice daily in the case of the nitric acid works, their nitrogen content—the most expensive element in use—and the average rate of discharge during the 24 hours. Unexpected losses from storage tanks, etc., may thus declare themselves, or an indication of a works mishap, which possibly occurred on the night shift and was not reported, may be obtained. The losses may be graphed in lb. weight per 24 hours, and also in £ sterling for the same period. The use of such a chart keeps the order of the losses before the men concerned, and they soon discover that preventible losses will not necessarily be hidden from the management by reason of the plant being cleaned down quickly. Faulty plant design may be indicated; for instance, launders set with a very small fall so that they run nearly full, and a slight blockage causes an overflow. This method tends to discover hidden small but constant losses, such as those due to cracks in earthenware vessels, or pipe lines, particularly where these are practically hidden from general observation.

Sheet No. 1.

Factory at Penrhyndeudraeth, North Wales. ***Five weeks ended November 2, 1918***

NITRIC ACID.—Process Account.

Sheet Reference.	Production in tons of 2,240 lb. Total ..... 244·63 Less plant losses .... 18·75 Net production ..... 225·88	Actual. Quantity. Tons.	Rate. £	Per cent.	Converted as 100 per cent. Quantity. Tons.	Rate. £	Cost of Production as 100 per cent. £	Weight in tons of material used per unit ton as 100 per cent. produced. This Period.	Ref. Rpt.	Last Period.	Cost per ton at 100 per cent. This Period. £	Ref. Rpt.	Last Period. £
	1. MATERIALS USED—VIZ.:												
	Nitrate of Soda	357·05	22·90	95·3	340·269	24·029	8,176·445	1·506	—	1·506	36·198	—	36·191
9A	Sulphuric acid	342·38	6·00	93·18	319·030	6·440	2,054·500	1·412	—	1·394	9·096	—	8·797
					659·299		10,230·945	2·918		2·900	45·294		44·988
	2. PROCESS WAGES:												
	(*a*) Plant Officers.....	—	—	—	—	—	52·179	—	—	—	0·231	—	0·299
	(*b*) Operative Wages...	—	—	—	—	—	605·871	—	—	—	2·682	—	3·803
	(*c*) Overtime Allowances	—	—	—	—	—	35·359	—	—	—	0·157	—	0·134
	(*d*) Yard and Traffic ...	—	—	—	—	—	52·217	—	—	—	0·231	—	0·194
	(*e*) Motor Lorry	—	—	—	—	—	9·200	—	—	—	0·041	—	0·105
	3. FUEL, WATER, POWER, ETC.:												
	(*a*) Process Fuel:												
	Coal	—	—	—	57·9	1·627	94·233	·256	—	·389	0·418	—	0·640
	Coke	—	—	—	—	—	—	—	—	—	—	—	—
	Gas	—	—	—	—	—	—	—	—	—	—	—	—
	Oil	—	—	—	—	—	—	—	—	—	—	—	—
	(*b*) Water and Water Power	—	—	—	—	—	28·312	—	—	—	0·125	—	0·428
	(*c*) Steam and Steam Power	—	—	—	—	—	82·161	—	—	—	0·364	—	0·470
	(*d*) Electric Power and Light	—	—	—	—	—	7·946	—	—	—	0·035	—	0·063
	(*e*) Compressed Air	—	—	—	—	—	6·374	—	—	—	0·028	—	0·040
	(*f*) Refrigeration.....	—	—	—	—	—	—	—	—	—	—	—	—
	4. PLANT GENERAL EXPENSES:												
	(*a*) Plant Stores.....	—	—	—	—	—	0·050	—	—	—	—	—	—
	(*b*) Clothing	—	—	—	—	—	23·525	—	—	—	0·104	—	0·111
	(*c*) Shift House and Mess Room	—	—	—	—	—	—	—	—	—	—	—	—
	Handling of Nitre Cake	—	—	—	—	—	55·108	—	—	—	0·244	—	0·291
	5. MAINTENANCE OF PLANT AND PROCESS BUILDINGS:												
	(*a*) Materials.....	—	—	—	—	—	75·079	—	—	—	0·332	—	1·592
	(*b*) Wages	—	—	—	—	—	103·105	—	—	—	0·456	—	0·859
	(*c*) Oncost (Shops and Salaries)	—	—	—	—	—	30·887	—	—	—	0·137	—	0·193
	6. DEDUCT BY-PRODUCTS, ETC.:						11,492·551				50·879	—	54·210
	Sale of Scrap Material against Plant Replace	—	—	—	—	—	5·825	—	—	—	0·025	—	0·057
	Sale of Nitrate Bags....	—	—	—	—	—	52·800	—	—	—	0·234	—	0·456
	Sale of Nitre Cake.....	—	—	—	—	—	69·500	—	—	—	0·308	—	2·792
							11,364·426				50·312	—	50·905
	7. ADD ONCOST (GENERAL EXPENSES):	—	—	—	—	—	299·566	—	—	—	1·326	—	2·430
							11,663·992	—	—	—	51·638	—	53·335
	8. ADJUST FOR:	—	—	—	—	—	—	—	—	—	—	—	—
	Nitric Acid Produced....	—	—	Tons	225·88	51·638	£11,663·992	—	—	—	£51·638	—	£53·335

DIAGRAM I.

"Stainless Steel" in the Chemical Industry

By "Works Chemist"

THE acute problem of the corrosion of both ferrous and non-ferrous metals whilst in ordinary everyday use has been one of the most urgent and pressing in all metallurgy ever since its inception many thousands of years ago. We have it on the authority of the eminent metallurgist Sir Robert Hadfield that the annual loss of material through the ravages of corrosion amounts to the colossal sum of 500,000,000 pounds sterling. The plain statement of this fact makes it evident at once that the problem is indeed a very serious one, and in no branch of science is metallic corrosion more rife or more obvious than it is in the chemical industry, and it is probable that corrosion in this industry is attended with more serious, costly and even dangerous consequences, than is any other.

Although this problem cannot be considered to be solved by any means, yet within the last decade or so metallurgical knowledge has progressed at such a rate that to-day we have several alloys, both ferrous and non-ferrous, which will definitely resist corrosion to a very marked degree. One of the most outstanding examples of these alloys are stainless steels, and it may be said at once that were these steels adopted to a greater extent throughout all branches of industry, and the chemical industry in particular, then the above-mentioned enormous figure of wastage would be very materially reduced.

Before considering the properties of these steels it will perhaps be of interest to give a brief résumé of their earlier history. Stainless steels were discovered a dozen or so years ago at the works of T. Firth & Co., of Sheffield, which fact is, incidentally, a further proof of the supremacy of British steel makers. In a sense, their discovery may be considered as partly accidental, because this firm were experimenting with various alloy steels for the manufacture of gun tubes which would resist the erosion caused by the gases liberated by the combustion of the explosives better than does the customary nickel or carbon steels.

Although they considered that they had not solved the problem which they set out to solve, yet they discovered these extremely useful steels and immediately realised their extreme value for engineering and all other purposes where metals are utilised. At the outset there was only one stainless steel placed on the market which consisted of an alloy containing approximately ·35 per cent. carbon, 12 per cent. chromium and iron, plus the usual amount of other elements as found in ordinary carbon steels. Since then, however, they have, by dint of exhaustive experimenting, evolved other stainless steels, and so to-day there are as many stainless steels available as there are ordinary carbon steels, and these steels may be substituted for ordinary steels with great advantage.

Composition

Broadly speaking, stainless steels may be considered to be similar to ordinary steels, except that they all contain some 12·0 to 14·0 per cent. chromium in addition to the other ordinary elements, and therefore their stainless properties largely depend upon the presence of the metal chromium. Stainless iron, about which much has been heard of late, is really only a dead mild stainless steel—*i.e.*, it contains the ordinary 12-14 per cent. chromium and very little carbon. It must not, however, be confused with what is often termed acid-resisting iron, which alloy is analogous to cast iron and depends upon the addition of some 14 to 15 per cent. silicon for its corrosion-resisting properties. This latter alloy is decidedly hard and brittle, whilst stainless iron is soft and ductile; and so there is little need for confusion to exist between the two alloys. The following list gives the analysis of the stainless steels being manufactured to-day :—

Name.	Carbon Per cent.	Silicon Per cent.	Manganese Per cent.	Chromium Per cent.	Nickel Per cent.
Stainless iron.....	less than ·10	·08	·15	12 to 14	·60
Mild stainless steel	·10 to ·20	·15	·18	12 to 14	·57
Medium stainless steel .	·20 to ·30	·21	·18	12 to 14	·63
Stainless steel	·30 to ·40	·20	·20	12 to 14	·72
Hard stainless steel....	over ·50	·23	·22	12 to 14	·68

Properties of Stainless Steels

These steels, when correctly heat treated, will definitely resist corrosion of almost any description. Now, because some manufacturers declare that this statement is untrue, it requires some further elaboration. It cannot be over-emphasised that before these steels will exhibit their stainless properties to their fullest extent they must be in a correctly heat-treated condition, and therefore the reason why some manufacturers have a poor opinion of the corrosion-resisting properties of these steels is because they have tried them when they were not in their proper physical condition. Fortunately, the necessary heat-treatment is very simply carried out and it is similar to that given to all high-class alloy steels. The treatment merely consists of heating the steel to a temperature of about 940° C. and quenching it in oil. This renders the steel in its best possible corrosion-resisting state, but it also makes the steel too hard for most practical purposes. To reduce this hardness the steel is merely reheated up to a temperature of 650° C., which temperature reduces the hardness and increases the ductility of the steel. By simply varying this reheating temperature up to 650° C., any reasonable combination of mechanical properties may be obtained ranging from a maximum stress of 50 to 120 tons per square inch with an elongation of 23 per cent. to 4 per cent. respectively.

Advantages of Chromium Steels

The advantages of these steels may be enumerated as follows :—(1) They are high-tensile alloy steels capable of being hardened and tempered in the ordinary way; (2) they resist corrosion and erosion; (3) they are comparatively strong at high temperatures. As these three characteristics are not possessed by any other steel, the importance of them is obvious. In chemical engineering they are of prime importance, and in proof of this a few tests which have been carried out with stainless steels may be stated. Pieces of these stainless steels have been hung in the fume chamber of a chemical laboratory for several months and at the end of this time the amount of corrosion is practically nil. Stainless steel turbine blades have been used daily in turbines for several years, where they are subjected to the action of superheated steam at enormous pressures. When the turbine is dismantled it is found that the blades are in precisely the same condition as they were when first manufactured, and all other steel and non-ferrous alloy blades have to be renewed constantly at short intervals. Pump rods made from these alloys give remarkably good service, especially where acidified water has to be pumped, and besides great resistance to corrosion these rods wear much better than the usual bronze rods because they may be hardened to such a degree. When it is mentioned that optical mirrors are being manufactured from stainless steels it is conclusive that the claims made for them are in no way exaggerated. Besides their resistance to corrosion by gases or acids and the like, these steels also are extremely useful for withstanding constant heating without scaling and disintegrating. Pieces of these steels have been heated in the atmosphere to a temperature of 750° C. for a period of 200 hours, and at the end of this time the loss due to scaling amounts to less than a half of one per cent.

For many years alloys have been sought for which will remain comparatively strong at high temperatures, but until the advent of stainless and some other alloy steels, such alloys have not been obtainable. It is well known that 3 per cent. nickel or nickel chrome steel, even when heat-treated up to 120 tons per square inch, lose their strength when even moderately heated, and at dull red heats their strength is reduced enormously. At a temperature of about 700° C. these ordinary alloy steels drop to a maximum stress of only about ten tons per square inch, whilst stainless steels at this temperature give about 17 tons per square inch. At higher temperatures than 700° C. the superior strength of stainless steel is even more apparent, and therefore this extremely useful property makes these steels of still greater value, and in chemical engineering, where it often happens that strength at high temperatures is essential, these alloys are of particular value.

Disadvantages of Stainless Steels

In such an article as this it is only fair to state some of the various complaints which have been levelled at these steels from time to time. The first and most serious objection is their initial cost, which at the present time is somewhat high. This same objection, of course, usually applies to most other

articles of commerce when they are comparatively new on the market; but in the case of these steels it is only the initial cost which is high, and owing to their vastly superior service they are cheaper in the long run. This is the only objection which has been levelled against these steels which has any foundation in fact, but other objections are occasionally raised which are almost entirely fallacious.

For example, some people have objected to the expense and time involved in producing a highly polished surface on articles of these steels; but actually there is no necessity to go to this trouble and expense, because a high polish is not essential. It must be remembered, however, that all metals and alloys are more prone to corrosion when their surface is in a strained condition. This fact also applies to these steels, but polishing is not essential for removing the strained surface produced by, say, machining; and so long as the aforementioned heat treatment has been carried out after machining—which process removes the strained condition—then polishing is by no means essential. Another occasional complaint is that stainless steels are both difficult to forge and to machine, but this statement is quite erroneous, because these steels may be forged as easily as most other alloy steels, whilst when they are correctly heat-treated they are quite easily machinable at ordinary speeds.

It has been said that 25 per cent. nickel steel is as good as stainless steels; but this is not true, because these high nickel steels cannot be hardened and are extremely difficult to machine, besides being rather costly.

Conclusion

Millions of money are spent annually on painting and covering ferrous alloys to try to overcome corrosion, but only since the discovery of stainless steels has this become possible. The various surface treatments—which are expensive to carry out—such as silver and nickel plating, galvanising, costettising, sherardising and so forth, are entirely superseded by stainless steels, which need no surface treatment.

In all industries where corrosion of metals occurs, such as in chemical, soap, sugar and many other manufactories, these steels are an inestimable boon, and when it is remembered that corrosion has been the greatest drawback of ferrous alloys ever since they were discovered, many thousands of years ago, it will be agreed that the discovery of stainless steels must rank as one of the most important inventions in the whole history of metallurgy.

Storage of Anhydrous Aluminium Chloride

ANHYDROUS aluminium chloride should be stored in tight steel drums or boxes to prevent access of moisture, states Mr. O. C. Ralston, assistant chief metallurgist of the United States Bureau of Mines, Department of the Interior. One company uses lead-lined drums. Any drum used should be painted thickly on the outside to close pinholes or cracks through which water vapour could penetrate. When water vapour can enter it reacts fo form hydrochloric acid gas, which, on escaping through cracks or holes, attracts water and attacks the iron. If the aluminium chloride comes into contact with damp air for a few minutes before being placed in the drums, it takes up water and later releases hydrochloric acid gas, which is likely to burst the drums. For this reason the containers should be allowed to stand a few days and vented about twice daily until all evolution of gas has ceased before being permanently sealed. It has been suggested that the aluminium chloride for cracking oil be shipped suspended and covered by oil in tank cars with screw conveyers in the bottom for unloading.

Explosiveness of Hydrocarbons and Oils

THE results of tests made by the United States Department of the Interior at the Pittsburg experimental station of the Bureau of Mines indicate that oxygen at 2,500 lb. per square inch in contact with two typical oils without catalyser is probably incapable of spontaneous explosion at 60° C. when at rest in a pipe offering good heat conduction. New apparatus has been constructed and is nearly ready for observations along two new lines (1) electrostatic and ozone effects during flow through valve at moderate pressure; (2) continuation of previous work using a thermally insulated cell.

Poison Gas as a Cure for Disease

To the Editor of THE CHEMICAL AGE.

SIR,—In reference to your article in the May 19 number on American work on this subject, an atmosphere containing traces of gases such as Cl or SO_2 may protect people from infection by influenza, pneumonia or tuberculosis, but such people will perhaps be more prone to infection afterwards when removed from the protective influence.

The difficulty of drawing a hard and fast line between a disinfectant and a corrosive agent, is too well known to need any comment here; but the two following cases will be of some interest.

The small town (in the North East of England) immediately adjacent to the chemical works where I am now employed, was notably free from influenza during the epidemics of a few years ago. This immunity was doubtless due to the slight traces of SO_2, N_2O_4 and HF in our waste gases, though in concentrations seldom exceeding one-tenth that permitted by the Government inspector.

On the other hand, however, immediately after a slight exposure to German poison gas in 1918, I contracted pneumonia and was invalided home. The inference here being, that the natural power of a healthy man to resist the ubiquitous germ was impaired by this slight exposure to a corrosive gas.—Yours, etc.,

M. C., M. Sc.

May 24, 1923.

The Analysis of Margarine

To the Editor of THE CHEMICAL AGE.

SIR,—My attention has been drawn to a misprint in the recent article by me in your Journal on the "Analysis of Margarine."

In the first column, on page 451, line 23, the numerator of the fraction on the right hand side of the equation should consist of the whole of the top line, in place of only a portion of the line.—Yours, etc.,

May 28, 1923. G. D. ELSDON.

Chemicals from Granite

THE mineral felspar which is the principal constituent in many granites, has long been known to have a high content of potash, alumina, and silica, and it is now reported in the *Raw Materials Review* that a new process of treating the mineral in order to preserve the marketability of all three of its constituent oxides has been worked out by Mr. C. M. Brown, of Toronto. The results obtained by means of the Brown process are of marked interest to the technical world, as its operation will give a commercial value to many felspar deposits which are not now workable. It should ultimately make Canada more than self-supporting as regards supplies of potash and alumina and their commercial compounds. The clean residue of silica that remains after treatment of the felspar is also saleable. The process consists in the application of acid gases to finely ground felspar, in a rotary kiln, at low temperatures. The disintegration is continuous and complete, and the finished products are obtained by leaching and crystallisation.

Theoretically potash-felspar (orthoclase and microcline) contains 16·9 per cent. potash; 18·4 per cent. alumina; and 64·7 per cent. silica. In nature, however, the potash content rarely exceeds 12 or 13 per cent.; the alumina ranges from 17 per cent. to over 20 per cent.; and the silica is usually higher than the figure given above. Only rare deposits of felspar are pure enough to be suitable for use in the pottery and ceramic industries. Ordinary impurities do not affect its utility so far as the Brown process is concerned, and the conversion into commercial staple of both the potash and the alumina is the outstanding feature of a new system. The chemicals used are either given a higher value by combination with potash and alumina, or are continuously recoverable by the use of standard regenerative equipment. By means of the Brown process the 17 per cent. to 20 per cent. of alumina contained in potash-felspar can be converted either into aluminium sulphate, or partly into the combined sulphates of potash and aluminium, or partly, or wholly, into commercially pure alumina. In the latter form it would require less than half the quantity to make one pound of the metal aluminium, than in the case of bauxite used for the same purpose.

Notes on the Handling of Compressed Gases

The following notes are abstracted from a paper by Dr. A. D. Risteen, given before a joint meeting of the American Society of Safety Engineers and the Safety Codes Committee of the American Society of Mechanical Engineers.

Oxygen

Oxygen is compressed and sent out in vast quantities and is used in a great variety of ways. Before subjecting it to compression it is essential to know that the oxygen is pure, and especially to know that it is not contaminated with any other substance with which it could combine, either during compression or in the course of subsequent handling. For example, if it is prepared by the fractional distillation of liquid air, it is important to know that the air that was subjected to liquefaction was free from smoke particles, from organic dust of any kind, and from coal gas, acetylene, and every other substance of an oxidisable nature. If the oxygen was produced by the electrolysis of water, it is equally essential to know that it is not contaminated by hydrogen. It is easy enough to insure purity in all these respects, but the importance of not neglecting the necessary testing, and the purification operations when these prove to be needed, cannot be over-emphasised.

In handling compressed oxygen it is supremely important to prevent the gas from coming in contact with oil or grease either during the compression or while the oxygen is being stored, transported, or utilised; and in view of the fact that many exceedingly serious accidents have occurred in consequence of neglecting this principle, the author wishes to emphasise the hazard more strongly. When a man talks with appropriate earnestness about the danger of allowing compressed oxygen to come in contact with oil, grease, or other combustible organic materials, it is easy for the uninitiated to believe that he is inspired by unreasonable timidity, but this is not the case. Those who have followed the history of oxygen compression are well aware that many accidents have occurred under conditions that thoughtful and experienced men would not have considered to be at all likely to produce trouble. The use of even a slight trace of oil in the compressor is exceedingly hazardous, not only on account of the danger of immediate combustion, but also because some part of the oil is bound to go over with the compressed gas; this will collect in the tanks or cylinders used for storage purposes, and sooner or later serious results will surely follow. It is probably safe to say that most of the accidents that have occurred in connection with compressed oxygen have been due to lack of appreciation of the importance of this thing. The trouble is not confined, of course, to the mere combustion of the oil itself. The metal parts of the apparatus will burn freely as soon as they become sufficiently heated by the ignition of the oil or grease, and the consequences may transcend imagination.

The only absolutely safe thing to use for the lubrication of an oxygen-compressor cylinder is *pure water*, which should be introduced into the suction pipe in the form of a visible spray. Under special conditions it may happen that pure water is not sufficient, and in a case of this kind it may be permissible to dissolve a little soap in it; but soap should not be used when water will suffice, and it should *never* be used without first proving, by actual analysis, that the particular supply to be dissolved contains no uncombined (or unsaponified) oil or grease. The packings used on the compressor must also be entirely free from oil, grease, or graphite. Packings made for this express purpose should always be employed.

The compression of oxygen is often, and perhaps usually, carried up to about 2,000 lb. per sq. in., and it should be effected in not less than three stages. The importance of prompt and effective cooling is appreciated in the compression of air, and much greater attention should be paid to this point when compressing oxygen. The pump cylinders should be water-jacketed, the circulation of water should be positive and abundant, and the apparatus should be so designed that cessation or diminution of the flow of jacket water cannot escape immediate notice. The gas should also be passed through effective intercoolers between each compression stage and the one next following; and *immediately* after leaving the last cylinder of the compressor it must be passed through a final cooler, and brought down to the temperature of the surrounding atmosphere.

It is exceedingly unwise to introduce oxygen into receivers of any kind, unless these receivers are known to be perfectly clean internally and wholly free from oil, grease, and other combustible substances. The author would like to see some kind of regulation established forbidding every oxygen manufacturer to fill any tanks other than his own. This principle is already followed, it is believed, by some and perhaps all of the larger manufacturers, but unfortunately it is not followed by everybody. Moreover, oxygen should never be compressed into containers that have been used for other gases. When a cylinder or tank has been previously used for holding compressed gases other than oxygen, there is likely to be an accumulation of oil upon its inner surface, because oil may have been used for cylinder lubrication in connection with the compression of these other gases, and it is hard to remove such oil thoroughly enough to make the tank safe for oxygen.

Nitrogen

Nitrogen gas has a far narrower range of application than oxygen, yet it is compressed to a certain extent. This gas was used during the war in the recoil cylinders of certain types of guns, and it has also been used to a limited extent for blanketing combustible liquids and for supplying a neutral atmosphere for other purposes where the presence of a gas with active chemical properties would be objectionable. At the present time compressed nitrogen is supplied mainly, it is believed, for filling incandescent electric lamps, and in connection with the manufacture of automobile tyres.

Nitrogen forms four-fifths of the bulk of the atmosphere, and as it is nearly inert in its elemental form the precautions observed in the compression of air are also adequate when compressing nitrogen. It should be noted, however, that the nitrogen that is used for filling electric-lamp bulbs must be free from hydrocarbons, and this means that when the gas is to be employed for this purpose it is not permissible to use oil for lubricating the compressor cylinders. Water should be used instead. It is best to avoid oil altogether and to lubricate with water in all cases. This does not mean, however, that there is any danger of direct chemical action between the oil and the nitrogen. Nitrogen is usually compressed to about 2,000 lb. per sq. in., and the compression should be performed in three stages.

Carbon Dioxide

This gas is compressed in large quantities and is used for the most varied purposes. As is well known, it will neither burn nor support combustion, and the author does not recall any chemical dangers which are likely to be encountered in its compression. It is not especially poisonous, but when a considerable quantity of it is mixed with the air that the workmen have to breathe, it replaces the life-giving oxygen to a corresponding extent, and this may mean that the air is not fit for respiration. The effects of carbon dioxide in this way are sometimes very insidious, especially as the pure gas is without odour or colour; and it is therefore evident that special care should be taken to provide free and copious ventilation at all times in buildings in which carbon dioxide may escape, by leakage or otherwise.

Hydrogen

In connection with hydrogen and most of the other combustible gases (such as propane), the chief danger associated with compression probably consists in the likelihood of fire or explosion in case of leakage or of contamination with oxygen. If the hydrogen is prepared by the electrolysis of water, there is always a possibility that oxygen may be present in it in small amounts, and the gas should be carefully tested, either at short intervals or preferably by some continuous process, to make sure that the oxygen content is always well below 5 per cent. Small amounts of oxygen can be removed by passing the gas over palladium pumice, which causes the oxygen to combine in a quiet way with an equivalent quantity of hydrogen.

The danger of admixture with air or oxygen is not in any way restricted to hydrogen prepared by the electrolytic

process. Air may leak into the suction pipe leading to the compressor, whatever the source of the hydrogen; and this, in fact, is one of the hazards that must be watched most carefully in handling this gas. The suction line may be fitted with test cocks or drainage valves, and when this is the case it is exceedingly important to keep them closed except when they are opened for legitimate purposes and at proper times. It is believed, moreover, that all such cocks and valves should be kept locked, and that the keys should be in the keeping of some designated, responsible man. To guard further against trouble from this source and from accidental leakage, the whole operation should be conducted so that there will be a positive pressure in the suction line *at all times*. Care should also be taken that the gasometer does not stick and that its seams are kept absolutely tight.

It is important to consider the possibility of leakage outward as well as inward. Hydrogen is usually compressed to a pressure of 1,800 or 2,000 lb. per sq. in., and at high pressures a good deal of gas will escape through a small hole in a short time. If hydrogen gets out into the room and is allowed to collect there, a serious explosion is likely to result. Every discoverable source of ignition should be carefully considered and safeguarded. Vigorous measures should be taken to prevent the men from smoking or using matches or other sources of open flame. The artificial lighting should be provided by incandescent electric lamps enclosed in vapour-proof globes, and it is safest to mount these lamps outside the windows, locating them so that they shine through the window glass into the interior. All electric wires should be run in closed conduits, and the fuses should invariably be outside of the region of possible danger. This applies also to switches, unless they are of a type which cannot produce an arc or flame. No electric motors should be used in rooms where hydrogen, propane, or any other combustible gas may escape in quantity, unless these motors are specially designed for this particular application, or else thoroughly ventilated by fresh, pure air from the outside of the building. And these various precautions should be observed not only where the hydrogen is compressed, but also wherever it is stored—either in gasometers or in cylinders. Finally, it is exceedingly important to provide abundant ventilation at all times to lessen the chance of fire or explosion in case the other precautions prove inadequate.

Left-handed threads are extensively used for fittings that are to be employed in connection with hydrogen, the purpose being to prevent the accidental connection of hydrogen lines or cylinders with pipe lines conveying other gases, and especially with those containing air or oxygen. It is to be regretted that in many plants the purpose of the left-handed thread is deliberately defeated by making use of devices known as "adapters." These are in effect right-and-left couplings, which are provided for the express purpose of making it possible to attach a cylinder with a left-handed thread to a pipe line having a right-handed thread.

Canadian Salt Cake Industry

THE Salts and Chemicals, Ltd., has a plant at Dana, Saskatchewan, Canada, which is nearly completed for the extraction of salt cake and other chemical products from the brine of Muskiki Lake. The company also has a refining plant at Kitchener, Ontario, and it is estimated that when this is in operation there will be an output of 30,000 tons of salt cake per year in addition to Epsom and other salts as by-products. The Bishopric and Lent Co., of Cincinnati, has practically completed the construction of a salt cake recovery plant at Frederick Lake, five miles south-west of Dunkirk, Saskatchewan, which will have a capacity of 50 tons of salt cake per day. Further units will be added to increase the output to 200 tons per day.

Soda Deposits, Ltd., a company with head office at Calgary, is operating an experimental plant at a lake five miles north of Fusilier, in Saskatchewan. This deposit, though not so large as some of the others, contains sodium sulphate in a very pure state.

The Basque Chemical Co. is working on a series of five lakes 15 miles west of Ashcroft, British Columbia, from which they are extracting crude magnesium sulphate. This is refined in Vancouver and sold for medical purposes and for use in the tanning industry.

Research on Benzol Recovery

Deterioration of the Wash Oil

AT the general meeting of the Coke Oven Managers' Association (Northern Section), at Darlington, on Saturday, May 26th, with Mr. T. Johnson, B.Sc., in the chair, a paper was read by Mr. T. BIDDULPH-SMITH on "A Suggested Application of Results of Research to the Practice of Benzol Recovery."

Experiments by the author showed that except in minute instances the raising of the average molecular weight of wash-oils was not due to dissociation of the oil molecules with the precipitation of carbon, as was often accepted, since if a sample of oil of known specific gravity was heated under a reflux condenser for a period of ten to twenty days, no appreciable alteration in specific gravity was observed, although in the presence of certain metals—*e.g.*, copper in a finely divided state, the latter acted as catalysts, and an extremely fine disposition of a mixture of carbon and sulphides of the metals became apparent; but the specific gravity variation was too slight to estimate. It was, therefore, necessary to look to other sources for the cause. When a sample of ordinary circulating oil, which was "spent," was examined microscopically, a considerable amount of suspended matter was observed, which was often incorrectly considered to be carbon.

Use of a "Salty" Oil

It was found that the suspended matter was easily filtered from the oil by means of ordinary filter cloth, and after repeated extraction with benzene, to remove the oil present, 4·5 grms. of intensely black residue was obtained from 250 grms. of oil. Upon extraction with, first, water and later dilute hydrochloric acid the residue was reduced to ·18 grms., and was found to consist mainly of carbon together with traces of ferrous sulphide, being ·072 per cent. by weight of the original oil. When it was appreciated that with a "salty" oil the contained water would be a saturated solution, it would be obvious that in most plants the boiling point of that solution would not be reached in the superheaters, and even if the oil left the still at 108° C., the water content would be increasing instead of decreasing. The effect of the presence of water on the absorption power of wash oil had been a battle-ground of conflicting opinions for a considerable time. Many experts—counting amongst their number most of the theorists—stated that the presence of water emulsified with the oil reduced the absorption power, whilst others, who, for some reason, had had occasional trouble with their heaters, and consequently emulsified oil, had been astonished to find that the production of benzol had been considerably increased. On experiment the author found that the percentage covering power of the oil was lowered by 7·5 per cent. on the addition to dry oil of 5·0 per cent. of water; therefore no one would expect a lowering of efficiency when water was present. In the author's opinion the good results obtained under such circumstances were due to the fact that benzol and its homologues were easily distilled in steam, and, therefore, a large portion of them left the oil together with the great quantities of steam liberated in the heater, thus giving the oil a preliminary steam distillation before entering the still, and consequently ensuring a better stripping. Tests of rich and stripped oils taken simultaneously also bore out that opinion.

Alteration in Standards Suggested

So far, however, the many troubles of working with emulsified oil, such as the difficulty of cooling, etc., had discouraged the continuance of the practice longer than was necessary. He went on to suggest two possible methods of eliminating suspended matter and water. The principal cause for the raising of the average molecular weight of wash-oil was the distillation out of the lighter products, and since in continuous use it was impossible to completely strip the oil of its absorbed constituents without also extracting those products. The ideal method would be to start with a wash-oil boiling at 200° C., and having a yield of 80–90 per cent. at 300° C. After enriching, this should be completely stripped in an efficient plant, no regard being taken as to the strength of the benzol. The distillate should then be redistilled in a "crude" pot-still to 200° C., and the residue, after extracting the naphthalene, be returned to the oil circulation. By that means crude benzol 100 per cent. at 200° C. would be made, and the wash-oil would maintain for a considerably longer period its molecular weight and also, providing that the sus-

pended matter was removed, its absorbing efficiency. The main drawback appeared to be that buyers of the crude benzol were in most cases the manufacturers of wash-oil, and would not readily give up the advantages which they obtained through the standard being 65 per cent. at 120° C. to the loss of the crude benzol manufacturers. The author therefore suggested that the National Benzol Association had a golden opportunity to further justify its existence by taking the lead and insisting that the old standard be replaced by a more scientific and fairer one—*e.g.*, 100 per cent. at 200° C.

The German Potash Industry

Enormous Increase in Export Prices

In Appendix XVII to the newly issued official Report on the Economic and Financial conditions in Germany, a summary is given of the German potash industry.

The importance of the German potash industry, it is stated, will be realised when it is remembered that of a world consumption of 1,600,000 tons, Germany alone during 1922 supplied some 1,300,000 tons. The fears expressed in German industrial circles that by the loss of the potash mines in Alsace the German potash monopoly would be broken do not appear to have been justified, and, although Alsace is the chief competitor with a production in 1921 of 110,600 tons, or 12 per cent. of the German output, Germany succeeded during last year in increasing her sales of potash by some 200,000 tons over the 1913 figures when she was still in possession of those works. This has been mainly achieved by concentrating effort on the most productive works and closing those of lesser yield and by the renovation and extension of plant.

Beyond Alsace, the only other competitor is Spain, but little fear is felt in this direction, as the output is comparatively small and the salts of inferior quality. The German Potash Syndicate now comprises 219 undertakings, including eight special factories, and the industry gives employment to some 50,000 workers.

Output

Up to the end of November, 1922, the output of pure potash amounted to 1,220,600 tons as against 800,000 tons during the same period in 1921, and it may be estimated that the production for the year amounted to some 1,300,000 tons, an increase of 380,000 tons over the 1921 production.

Inland Sales

From the beginning of the year business was very brisk, the sales in the first quarter exceeding those for the same period in 1921 by 60,000 tons. For the first nine months of the year inland sales amounted to 750,000 tons as against 530,000 tons during the same period in 1921. In order to give a stimulus to business during the summer months the Potash Syndicate decided to introduce the so-called "summer discounts," and this, in conjunction with the railway freight reductions granted with a view to relieving congestion in the autumn, produced results which surpassed all expectations. The fear of future price increases also contributed in a large degree to the increased demand during the spring.

Export

Business connections which had been interrupted by the war have again been taken up and exports are taking place to most countries of the world, and even Russia has entered the market, although she is not taking any very large quantities.

The exports during the first nine months of 1922 amounted to 240,000 tons as against 92,100 during the same period of the preceding year. The most important market is still the United States, who before the war drew about 250,000 tons, or 40 per cent. of the total German sales. Their requirements after the war fell off, and in 1921 they took only 39,500 tons. This was due partly to the general sale crisis and partly to competition from Alsace, where exports are favoured, contrary to the German policy, at the expense of the home agricultural industry, and about one-half of their 1921 production which amounted to 110,600 tons was dispatched to the United States. The attempt to introduce a high import tariff in that country failed, and the way was cleared for the German industry to conclude contracts for many years with the American fertiliser trusts, and exports for the first nine months of 1922 amounted to 91,700 tons.

Sales and Price Development

In the following table the development of sales from 1913-1921 is given, together with the value in marks. The figures for 1922 are not yet available, but sales amounted to some 1,300,000 tons :—

	Pure Potash.	Value.	Average Price per Ton.
	Tons.	Marks.	Marks.
1913	1,110,500	185,466,000	167
1914	903,900	150,603,000	166·70
1915	679,700	102,011,000	150
1916	883,900	157,369,000	178
1917	1,004,200	218,460,000	217·50
1918	1,001,600	278,677,000	278·20
1919	812,000	1,260,301,000	1,552
1920	923,600	1,517,865,000	1,626
1921	921,147	2,072,101,000	2,250

During 1922 it was found necessary to increase prices on twelve different occasions, the price at the end of the year being forty times that at the beginning and 800 times that in 1913. It has, however, been the policy to keep inland prices as low as possible, using part of the proceeds obtained from the higher priced exports for this purpose, and the potash price increases bear no relation to the increases in price of materials in other industries. The fixing of prices which was previously in the hands of the State Potash Council was transferred to a commission consisting of two representatives each of works, consumers and workers.

Internal Development

The work of consolidation made considerable progress during the year ; most of the renovation has been completed, and a considerable amount of new plant has been installed for the utilisation of by-products which are being manufactured with increasing success ; the most important of these are sulphate of soda, sulphate of magnesium, hydrochloric acid and magnesite. Chloride of potassium is attaining more and more importance in view of its richness which makes it cheaper to despatch than the crude salt. A good deal of attention has also been devoted to the production of mixed fertilisers and, following the American principle, it is intended to supply farmers with the finished full-fertiliser consisting of potassium salts, phosphoric acid, nitrogen and lime, in order to give more impetus to consumption. It is noteworthy in this connection that one of the most important chemical factories, the Oberschlesische Kokswerke, has acquired an interest in the Burbach concern and further extension in this direction may be expected.

A great many technical innovations were introduced into the rock salt industry, and sales underwent a further improvement, exports amounting to 1,000,000 tons as against 570,000 tons in 1921. The chief markets were the Near and Far East, China and Japan. Some 700,000 tons were absorbed by the internal demand.

The concentration movement made further progress during the year ; hitherto this has been in a horizontal direction, but the combination of the Oberschlesische Kokswerke and the Burbach concern, of which mention was made above, would give reason to believe that the movement may be carried on vertically in the near future.

In view of the depreciation of currency, numerous capital increases took place : the Salzdetfurth, Westregeln, Aschersleben and Friedrichshall companies each increased their capital to 100 million marks ; Kruegershall by 35 million to 160 million marks, the Kaliindustrie A.G. by 900 million to 1,050 million marks. The issue of new ordinary shares amounted to a nominal value of 442·3 million marks, and preference shares with plural voting power to 29·5 million marks.

Russian Superphosphate Fertilisers

The Russian Fertilisers' Institute has presented a report to the Scientifico-Technical Committee of the Supreme Economic Council on the new method for obtaining superphosphate from phosphorite mineral poor in phosphorus and containing an excess of polybasic acids. This class of mineral is very widely distributed over Russia and according to the method submitted by the Institute named, superphosphate is made up to 20 per cent. soluble in water from these minerals. The process as carried out in the laboratory has been recognised as practical, and its application on a moderate scale in one of the existing superphosphate factories is recommended.

Chemical Matters in Parliament

Reparation Dyes

Captain Wedgwood Benn (House of Commons, May 29) asked whether the seizure of dyeworks in the occupied territory of Germany by the French had had any effect on the delivery of reparation dyes to this country. Sir Philip Lloyd-Greame (Board of Trade) replied that H.M. Government had taken such action as appeared desirable to avoid interruption of delivery of reparation dyes. Satisfactory assurances had been given by the French Government, and facilities accorded on the spot by the French authorities.

Captain Benn asked if there had been any effect on the delivery of dyes. Sir P. Lloyd-Greame said that one of our representatives visited the dyeworks, and had had every facility for identifying any parcel of dyes destined for this country. Captain Wedgwood Benn repeated his question as to whether the dyes had come to this country or not.

Lieutenant-Commander Astbury asked if Sir P. Lloyd-Greame was aware that there is not a single works which is in want of dyes ?

Sir P. Lloyd-Greame, in reply, said, " I believe that is substantially true, but I cannot say to what extent interruption has taken place. There is a good deal of interruption and delay in the delivery of dyes. What I thought Captain Wedgwood Benn wished to know was whether we were taking every effective step to ensure delivery."

Captain Wedgwood Benn inquired whether the French occupation had stopped delivery, to which Sir P. Lloyd-Greame replied, " Up to the present, no ; and the French have given us every facility for collecting the parcels of dyes."

Value of Dyestuff Imports

Mr. Hannon (House of Commons, May 29) asked the President of the Board of Trade the value of dyestuffs imported and produced in the United Kingdom in 1914, and also for the corresponding figures for 1922.

Sir P. Lloyd-Greame, in reply, gave the following statement, which gives the desired information, so far as it is available, but in view of the fact that the trade of 1914 was affected by the War, particulars as to imports in 1913 are also included. There have been great changes in the level of prices, and the imports of 1913 included a much larger proportion of the lower-valued dyes than those of 1922 :—

Quantities and values of dyes and dyestuffs obtained from coal tar imported into the United Kingdom during the years 1913, 1914 and 1922 are as follows :—

	Cwts.	£
1913	377,884	1,892,055
1914	213,522	1,291,430
1922	58,591	1,326,174

No precise data as to the production in 1913 and 1914 in the United Kingdom of dyes and dyestuffs derived from coal tar are available, but it is estimated that in 1913 it did not exceed 50,000 cwt. and was largely from imported intermediates ; the total value was probably less than £200,000. In 1922 the total British production, which owing to the general trade depression was much below the capacity of the British makers, amounted to 180,000 cwt., and was entirely from intermediates produced in this country ; the approximate value was £3,000,000. The above statement of imports does not include natural indigo and natural extracts for dyeing.

" By-Product Coking "

For some years the late Mr. Stanley Cooper's book on " By-Product Coking " has been the standard work on this important subject, and to meet the continuous demand for it Messrs. Ernest Benn have just published in a greatly enlarged and revised form a new edition edited by Mr. Ernest M. Myers, F.C.S., fuel technologist to the Shelton Iron, Steel and Coal Co., Stoke-on-Trent. In its expanded form the work is a complete guide to the operation of the different systems of coke ovens and recovery plant, and to the most modern and economical methods of recovering and marketing by-products, including surplus coke oven gas.

The same firm are also just publishing the first modern authoritative text-book on Gas Producers. The author, Mr. N. E. Rambush, well known as one of the pioneers in this country of low-temperature producer gas generation, has so planned his book as to make it an essential work of reference for all concerned with producer gas manufacture, and in particular with the operation of water gas plant. Not the least interesting feature is the special attention paid to the recovery of ammonia and low-temperature tar oils.

New Dyestuff of the Indigo Series

Wool Dyed in one Immersion

Dimethyl-indigo, the methyl groups of which are in the para position with respect to imino group, is derived either from the 1-nitro-4-methyl-6-benzaldehyde by condensation of the latter with acetone in an alkiline medium (J. Koetschet, *Revue des Matieres Colorantes*, 5, p. 160, 1900), or from the alkaline melting of para-tolyl-glycin by the modified Heumann process. This colouring matter has not been adopted in practice owing to the dull shades with which it dyes wool or cotton, states the American *Colour Trade Journal*.

M. Bouvier, of Lyons, France, in *U.S. Patent* 1,412,038, announces that the preperties of the said colouring matter are entirely modified by the introduction of one or two atoms of a halogen. The halogenation can be performed by any one of the known methods. Several of such methods are given, for instance, by Reihter, *Traite de Chimie Organique*, 2, Paris, 1918, such as direct halogenation of indigo in the absence of water, in a hot benzenic solution, in concentrated sulphuric acid solution or in cold chloro-sulphonic acid.

The p-p'-tolyl-dibrom-indigo (5-5'-dimethyl-dibrom-indigo) has the appearance of a dark blue powder similar to the p-p'-tolyl-indigo. Its trace has a beautiful coppery sheen. Its properties are as follows :—

Solvent.	Colour of the Solution.
Cold conc. sulphuric acid .	Green
Hot conc. sulphuric acid at 212° F.	Bluish green, sulphonated with difficulty
Cold aniline.....	Green
Boiling aniline	Very sharp blue
Cold nitrobenzene	Blue, slightly greenish
Boiling nitrobenzene	Blue, purple by transmitted light
Chloroform	Little soluble, blue, slightly green
Acetone	Little soluble, blue, slightly purple
Benzene.....	Little soluble, purple blue
Alcohol	Little soluble, blue green
Carbon tetrachloride	Little soluble, purple blue
Carbon sulphide	Little soluble, blue
Acetic acid	Blue
Hydrosulphite vat	Greenish yellow

It is reduced by hyposulphite of soda in an alkaline solution in a similar manner to p-p'-dimethyl-indigo. But it behaves in an entirely different manner towards textile fibres, vegetable and animal.

A Cotton and Wool Dye

The product is a dye both for cotton and for wool. It is, therefore, only to be compared with the ordinary di- and tri-brom-indigos, the higher derivatives not being adapted to dye animal fibres. On cotton the shades it gives are of a very decided and sharp blue less reddish than those given by the dibrom-indigo and very different from those of the tribrom-indigo, which are very greenish. It covers and unites very well, its affinity is to be compared to that of the tribrom-indigo, which is very good, it is very superior to that of the dibrom-indigo. While the di- and tri- brom-indigos have but little sheen on cotton the new product has a relatively strong sheen similar to that of the tetabrom-indigo.

On wool it is still more remarkable than on cotton, the dyes obtained by its means are extraordinarily sharp, its affinity exceeds that of the dibrom-indigo, which is considered as being very good and which is the best of the series of the ordinary indigos ; it exceeds also that of its ortho-methylated isomer. It dyes wool in the darkest shades in one dip, the tints are comparable in sharpness with those of the finest acid dyes (Alizarine Blue, for instance). The para-tolyl-brom-indigo dyes wool in the same tone as cotton, which is not quite attained with dibrom-indigo and far from being the case with tribrom-indigo.

To sum up, the introduction of the halogen in the molecule of the p-p'-dimethylindigo enhances considerably its affinity for wool and for cotton, as well as its colouring power, it modifies the shade of the tints and renders them more sharp and decided.

The monobrominated derivative has similar properties, but less developed, being intermediate between those of the p-p'-dimethylindigo and those of the derivative above described.

From Week to Week

EXPORTS of chemical products from Canada during the past fiscal year amounted to $1 4,046,940, as compared with the 1921-22 total of $9,506,170.

IT IS PROPOSED to confer the degree of D.Sc. at the forthcoming commemoration at Oxford upon Sir Ernest Rutherford, F.R.S., Professor of Physics at Cambridge.

SIR WILLIAM PEARCE, vice-chairman of the Association of British Chemical Manufacturers, has been appointed to the Advisory Committee of the Department of Overseas Trade.

A DEMONSTRATION of the Peachey process for the cold vulcanisation of rubber was given on Thursday, May 24, at Willesden, in the laboratories of the company owning the patents.

THE NEWCASTLE section of the Society of Chemical Industry paid a visit on Wednesday to the Redheugh Works of the Newcastle and Gateshead Gas Co., through the courtesy of the directors and Mr. F. P. Tarratt (engineer).

IT IS REPORTED from Coblence that in consequence of Germany's default in the matter of deliveries in kind, laid down in the Versailles Treaty, stocks of chemical manures were seized on Monday at the Oppau works of the Badische Anilin and Soda Fabrik.

PROFESSOR F. G. DONNAN, F.R.S., will take the chair at the first lecture, on Wednesday, June 6, of a series on "The Structure and Behaviour of the Molecule," by Professor Gilbert Lewis (of the University of California), to be given in the chemical department, University College, London.

AMONG the appointments made to the Railway Rates Tribunal for the period ending March 31, 1924, are the following representatives of various trading interests:—Mr. E. Hoyle (Brunner, Mond and Co.), Mr. J. Ewing (Bradford Dyers' Association), and Major-General S. S. Long (Lever Bros. Ltd.).

THE COUNCIL of the Institute of Chemistry of Great Britain and Ireland advise any Fellow or Associate of the Institute who may contemplate accepting appointment as public analyst for the county or city of Gloucester on the terms recently advertised to communicate at once with the Registrar.

THE HARDSTOFT OIL-WELL in Derbyshire has been purchased by the Duke of Devonshire. The well was sunk on the Duke's Derbyshire estate by Messrs. Pearson on behalf of the Government, and steps are being taken to work it again. It is still yielding oil and negotiations are in progress for the development of the boring.

THE CONSTANT UNCERTAINTY of the general situation has seriously handicapped commerce in the Hamburg Chemical Market. The value of the mark having further declined owing to recent political developments, it is expected that business for export will improve there. Prices are quoted either in dollars, Swiss francs or pounds sterling.

THE DEATH is announced at Sandford Park, near Oxford of Mr. Edward Ferguson Chance, second son of the late Mr. Edward Chance, of Great Malvern, and was a partner in the firm of Chance Bros. and Co., glass manufacturers, etc., Spon Lane, Birmingham. When the firm was turned into a limited liability company he was made managing director, and in 1919 he became chairman.

A RANGE of natural dyes used in colouring food has been forwarded by the Department of Scientific and Industrial Research, Whitehall, to Professor A. G. Perkin, F.R.S., of Leeds University, in order that he may examine the question of the importance of natural dyes for foodstuffs. It is thought that the question of extending the use of British-made synthetic dyes for foodstuffs is to be considered.

THE ANNUAL DINNER of the British Science Guild was held on Wednesday, Lord Askwith, the president, taking the chair, and proposing the toast "Science and the Empire," in which he spoke of the necessity for the establishment of an Empire patent law. It was his hope that this and similar subjects would be discussed at the Imperial Conference to be held this autumn. Sir William Bragg, supported the toast and dwelt on the work of the laboratories in relation to our modern life.

THE FIRST ANNUAL CORPORATE MEETING of the Institution of Chemical Engineers will be held on Friday, June 8, 1923, at the Engineers' Club, 39, Coventry Street, London, W.1. The President, Sir Arthur Duckham, will take the chair. After the formal business has been concluded, tea will be served, and at 5 p.m. Mr. T. C. Finlayson, B.Sc., Associate-Member of the Institution, will give a short account of his paper on "Industrial Oxygen," which will be followed by discussion. At 8 p.m. an informal dinner will be held in the Club.

IN THE RESUMED INQUEST on the victims of the recent explosion at Gatebeck Gunpowder Works, near Kendal, witnesses stated that everything at the corning-house, where the explosion occurred, appeared to be all right previous to the explosion, and the machinery was working perfectly, but two witnesses disagreed as to whether the machinery was running at the time of the explosion. The Coroner said he would return a verdict that the two men were killed by the explosion, and that there was no evidence to show how the explosion occurred.

AT CAMBRIDGE it is intended shortly to confer honorary degrees of Sc.D. on Wilder Dwight Bancroft, Professor of Chemistry in Cornell University; Ernst Julius Cohen, Professor of Chemistry in the University of Utrecht; Albin Haller, President of the Academy of Sciences of the Institute of France; Charles Moureu, Professor of Chemistry in the College of France; Raffaelo Naisni, Professor of Chemistry in the University of Pisa; Amé Pictet, Professor of Chemistry on the University of Geneva; and Frédéric Swarts, Professor of Chemistry in the University of Ghent.

ON WEDNESDAY the Earl of Durham, as Lord Lieutenant of the County of Durham, and Chancellor of Durham University, placed a commemoration tablet in the new science buildings in course of erection by the University of Durham. The buildings will comprise twenty-nine rooms, and will provide accommodation for instruction practice in chemistry, physics, geology, and botany, as well as private rooms for professors and staff and common rooms for students. The buildings now being constructed form a part of a larger scheme, and it is hoped to extend them as the school of science develops. The main laboratories will be permanently of one storey in height. The site is about ten acres in extent, and thus provides adequate space for extension to the south and east without interverence with the present design.

THE CHEMICAL SOCIETY will hold an ordinary scientific meeting on Thursday, June 7, 1923, at 8 p.m., when the following papers will be read: "Investigations on the dependence of rotatory power on chemical constitution, Part XX. The rational study of optical properties; Refraction a constitutive property," by Mr. H. Hunter. "Researches on indium, Part I. Dipehnyl indium chloride and phenyl indium oxide," by Mr. A. E. Goddard. "The properties of ammonium nitrate, Part VI. The reciprocal salt pair, ammonium nitrate and potassium sulphate," by Messrs. E. P. Porman and W. J. Howells. "Ring chain tautomerism, Part VI. The mechanism of the ketocyclol change in the propane series," by Messrs. E. W. Lanfear and J. F. Thorpe. "The rebersibility of additive reactions, Part I. The aldol reaction," by Mr. E. H. Usherwood. "Mechanism of the pinacone-pinacoline and Wagner-Merrwein transformations," by Mr. C. K. Ingold. "Researches on antimony, Part I. Tri-m-xylylstibine and its derivatives," by Mr. A. E. Goddard.

THE BRITISH ENGINEERING STANDARDS ASSOCIATION has recently issued a specification, No. 186-1923, for cast iron and enamelled cast iron steam-jacketed pans, the designs for which were prepared by the Joint Committee of the Association of British Chemical Manufacturers and the British Chemical Plant Manufacturers' Association. Tables are included in the specification which give the dimensions for pans of both shallow and deep type, the capacity of the former ranging from 26 to 100 gallons and of the latter from 10 to 200 galls. The tables are accompanied by complete key diagrams on which the dimensions are given. Equivalent capacities in litres are also given for the convenience of those using metric units. The tables are preceded by clauses dealing, among other matters, with enamelling working pressure and the tests to be applied to the complete pan ready for service. Copies of the specification may be obtained from the offices of the B.E.S.A., 28, Victoria Street, London, S.W.1, price 1s. 2d., post free.

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Abstracts of Complete Specifications

196,641. Cellulose Acetates. J. O. Zdanowich, 36, St. James' Street, London, S.W.1. Application date, November 22, 1921.

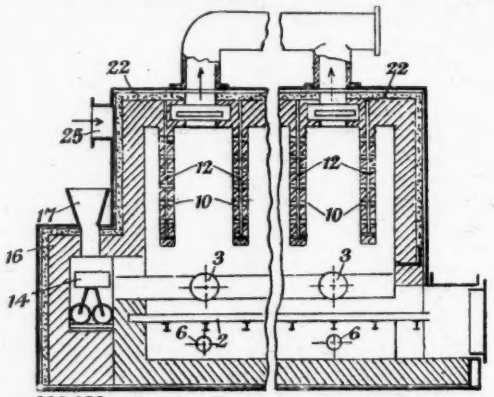
Specification No. 139,232 (see The Chemical Age, Vol. II, p. 360), describes a process for producing cellulose acetates by use of glacial acetic acid in the proportion of 3·5—5 times the weight of the cellulose. It is now found that an improved result may be obtained by increasing the quantity of glacial acetic acid to about nine times that of the cellulose. The use of the acetic acid may be divided into two stages and a small proportion of sulphuric acid or other strong condensing agent may be added. In an example, cellulose is mixed with about three times its weight of acetic anhydride and about nine times its weight of glacial acetic acid. The mixture is heated to about 40°–50° C., and chlorine is slowly passed through it until partial or complete disintegration of the cellulose takes place. The mixture is then cooled to 15°–18° C., and strong sulphuric acid in the proportion of about 0·5–1·5 per cent. by weight of the cellulose is added. If this mixture does not become clear in 2 to 3 hours, it is desirable to add the sulphuric acid at intervals. The glacial acetic acid acts principally as a solvent, and may be replaced by other solvents such as formic acid, ethylidene diacetyl, or tetrachlorethane. The product may be converted into artificial silk by direct extrusion nto a coagulating bath, without precipitation and redissolving.

196,646. Removing and Recovering Gases from Vapours, Means for. Joseph Crosfield and Sons, Ltd., Warrington, Lancs, and H. J. Wheaton, 5, Walton New Road, Lower Walton, near Warrington, Lancs. Application date, November 29, 1921.

Vapour may be removed from air or gas by passing it over base exchanging silicates, *i.e.*, simple or complex silicates containing an alkali metal as base with or without another metal or metals. These compounds are washed and dried at a temperature between 150° and 400° C. The manufacture of such silicates is described in Specification No. 177,746 (see The Chemical Age, Vol. VI, p. 602). The compound known as "permutite" is also suitable for this purpose. The silicates after use for absorbing vapours may be regenerated by heat or reduced pressure, or both. The temperature necessary depends on the vapour absorbed, *e.g.*, water vapour may be removed by heating to about 200° C., and petrol or benzol may be removed by heating to about 150° to 200° C.

196,658. Chemical Reactions and Physical Processes at High Temperatures, Process and Furnaces for. H. Mehner, 66, Schlosstrasse, Charlottenburg, Berlin. Application date, January 17, 1922.

This process is particularly suitable for carrying out endothermic reactions without the use of a muffle wall between the charge and the source of heat. The charge is subjected to radiation in a furnace heated by flame above or in front of the charge, with an intermediate layer of gas to prevent contact of the flame gases with the charge. This may be effected by introducing an atmosphere of fuel gas into the furnace, and then introducing air into the space above the charge so that it burns as an air flame in the gas. Instead of the fuel gas a layer of other gases may be used over the charge. Any volatile reaction product may be drawn off downwards through the hearth. In the application of the process to the production of metallic sodium, the charge consists of coal, with which sodium carbonate is either mixed or added as a superposed layer. An arched furnace is used and the fuel gas is introduced at openings 3 along the side just above the hearth. Air is forced through small ports in the arched roof, so that the roof is heated to incandescence and radiates heat upon the charge. Some of the fuel gas containing sodium vapour is drawn off through ports 6 leading from the space below the hearth 2. In the type of furnace shown in the illustration, the heat radiating surface is increased by means of transverse partitions 10 which may be provided with vertical apertures to increase the surface area further. The air supply for combustion is supplied through openings 25, and passes through filling material 22 to passages 12 in the partitions 10, and thence through small openings into the furnace. The sodium carbonate may be supplied to the charge from a travelling carriage 14, running along rails which are placed in recesses in the side walls of the furnace so that they are not subjected to radiation from the roof. A separate chamber 16 is provided at the end of the furnace to accommodate the carriage 14 when not in use, and the sodium carbonate is supplied to the carriage from a hopper 17. Alternatively, the soda may be distributed by means of nozzles or twyers. The soda is added in small quantities, so that the charge of



196,658

coal remains in a porous condition. The grate may comprise a number of plates placed on edge, cooled by water, and the plates are immersed in a sealing liquid which receives the sodium.

The process is also applicable to the reduction of compounds of other volatile metals, or for the production of illuminating gas from coal. If water vapour is admitted to the carbon, water-gas may be produced continuously, since the temperature of the carbon is maintained by radiation and not by intermittent combustion. The water-gas is thus produced at the most favourable temperature. The process is also applicable for the production of hydrogen and carbon dioxide from carbon and water vapour. In a modified form of furnace, the use of bricks in the interior is avoided by admitting the air through depending tubes of ceramic material. These tubes are supported by flanges at the top, and by an arch of fire clay or chamotte at their lower ends. In another form thin jets of flame may burn in a free furnace space. In this case the jets of air are injected upwards into the furnace space from an arched perforated pipe near the bottom. The furnace also facilitates the carrying out of other processes such as the burning of lime, in which case the carbon dioxide is obtained free from nitrogen. If water vapour is also supplied the dissociation temperature is lowered. Since contact of air with the limestone is not detrimental, gas flames instead of air flames may be used. Other modifications of the furnace are described, in which the charge to be heated is arranged in a vertical wall, and also in which water-cooled grates are used for the condensation of sodium. Gases of low fuel value may be used for heating the furnace; since the charge is heated by radiation only, the temperature to which it is heated is independent of the temperature along the path of the radiation. Very high temperatures of the furnace roof may be obtained if external loss of heat is avoided.

196,672. Amido Phenol Compounds. O. King, 35, Russell Road, Kensington, London, W.14. Application dates, January 24 and February 22, 1922.

The process is for producing a compound of amidol or diamido-phenol which does not readily oxidise or decompose either in crystalline form or when used in a photographic developer. The process comprises the treatment of 2 : 4-dinitrophenol with tin and hydrochloric acid. Hydrochloric acid free from iron is treated with just sufficient tin to produce stannous chloride. Small quantities of 2 : 4-dinitrophenol are added gradually during this reaction, and the temperature rises to boiling point. Heat is then applied for 10 to 15 minutes, and an addition compound of tin with diamido-

phenol is obtained. Strong hydrochloric acid is then added after cooling, and the precipitate filtered and washed with hydrochloric acid to free it from tin chloride. The diamido-phenol-tin compound is then dissolved to a concentrated aqueous solution, and an excess of sulphur dioxide is passed through it, yielding as a final product diamido-phenol-hydrochloride, diamido-phenol-stanno-chloride, and a combination of diamido-phenol and sulphur dioxide. This product is still more stable than that obtained without the sulphur dioxide treatment. In a modified process, an aqueous solution of amidol is boiled with a hydrochloric acid solution of stannous chloride until diamido-phenol-stanno-chloride commences to crystallise, and complete precipitation of this compound is then effected by cooling and adding concentrated hydrochloric acid.

196,680. Desulphurising Mineral Oils and Spirits, Method of and Means for. A. C. Nesfield, 16, Madeley Road, Ealing, London, W.5. Application date, January 25, 1922.

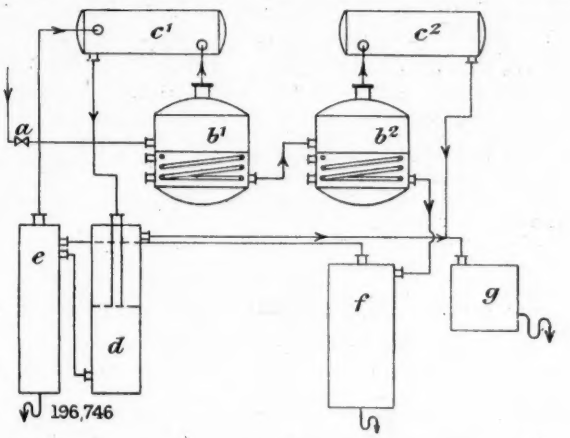
Mineral oil is desulphurised by subjecting it to continuous impregnation with a mixture of hydrochloric acid gas and air, with or without hydrogen. The oil is then washed with caustic soda or lime water, and the sulphur or sulphur compound is removed by filtration. The gas may be brought into contact with the oil when the latter is in the form of a film or spray, or the oil may be gasified and then treated. Crude oil or spirit may be subjected to a preliminary distillation, in which two fractions are collected, one terminating at about 392° F., and the other at about 750° F. Each fraction is separately desulphurised. The oil and gas are admitted to the bottom of a purifier containing several horizontal wire gauze screens of about 200 meshes per inch. The mixture passes upwards through these screens to an overflow near the top. The proportion of hydrochloric acid gas to air may vary from 1 : 10 to 1 : 100. The apparatus described in Specification No. 183,527 (see The Chemical Age, Vol. VII., p. 320) may also be used for impregnating the oil with gas, and in either case the oil is then washed with caustic soda or lime water, and then filtered. The desulphurised spirit may be decolorised by further washing with about 2 per cent. of sulphuric acid, and if any emulsification has taken place the oil may be finally washed with sodium chloride solution. In an example, crude shale oil containing 8·9 per cent. of sulphur may have its sulphur content reduced by this process to 0·76 per cent.

196,708. Bleaching Liquor from Chlorine Gas, Process for the Rapid Production of. J. Brandwood, T. Brandwood, and J. Brandwood, Walshaw Road, Elton, Bury, Lancs. Application date, February 2, 1922.

The object is to manufacture bleaching liquor from chlorine gas where required, without loss of gas. The gas is absorbed in an alkaline liquor by adding it to the liquor as it passes through the pump which communicates with the bleaching tank. The pump is preferably of the centrifugal type, which provides better agitation of the liquor with the gas. The gas is supplied under its own pressure and the suction of the pump, and it is found that the liquor enters the bleaching tank as a hypochlorite. The proportion of alkaline liquor and gas supplied is regulated as required to produce the hypochlorite. In this process, the whole of the chlorine contained in a cylinder of compressed gas may be extracted and used by means of the suction of the pump.

196,746. Separating Extracts from Mixtures of Organic Solvents, and Recovering the Latter, Process for. H. Bollmann, 1, Alsterdamm, Hamburg, Germany. Application date, February 17, 1922.

The process is for continuously recovering an extract from a mixture of solvents consisting of alcohol and benzol with less than 7·4 per cent. of water. The mixture is supplied through a valve a^1 to a still b^1, where it is heated to 65° C. Most of the water, mixed with alcohol and benzol, distils into the condenser c^1, and the condensate passes into the vessel d where it separates into two layers, benzol and alcohol above, and water and alcohol below. The latter mixture is rectified in a column e and the alcohol vapour passes into the condenser c^1. The residue passes from the still b^1 to the still b^2, where the remaining solvent is evaporated at 90° C., and condensed in a condenser c^2. The solvent from this condenser and from the upper layer in the vessel d is collected in a vessel g. The last traces of solvent are removed from the extract in the still f.



196,839. Detergents and Bleaching Agents, Manufacture of. Deutsche Gold und Silber Scheideanstalt, vorm. Roessler and O. Liebknecht, 7 and 9, Weissfrauenstrasse, Frankfurt on Main, Germany. Application date, June 6, 1922.

A good detergent and bleaching agent is produced by the interaction of sodium peroxide and bicarbonate in a solution of water glass. By altering the proportions, the content of active oxygen may be varied, and it may be increased by the addition of hydrogen peroxide at any stage of the process. The durability of the product may be increased by adding substances such as alkaline earth silicates, *e.g.*, magnesium silicate or calcium silicate. These substances may be produced *in situ* by the presence of a magnesium or calcium salt and an alkali silicate. Sodium peroxide is preferably first added to the water glass, and then the bicarbonate is added. The solution becomes viscous, then fluid again, and finally solidifies. The durability of the product may be further increased by drying. The content of active oxygen in the product may be brought down to any desired constant standard by the addition of soda. Detailed examples of the manufacture are given.

Note.—Abstracts of the following specifications which are now accepted, appeared in The Chemical Age when they became open to inspection under the International Convention :—172,302 (F. Frank) relating to the treatment of carbonacious or other materials, see Vol. VI, p. 177 ; 174,635 (Holzverkohlungs Industrie Akt.-Ges.) relating to the chlorination of acetylene, see Vol. VI, p. 465 ; 177,494 (Soc. Chimique de la Grande-Paroisse (Azote et Produits Chimiques) relating to the synthesis of ammonia by hyper-pressures, see Vol. VI, p. 706 ; 184,442 (Consortium für Elektro-chemische Industrie Ges.) relating to the improvement of artificial resins, see Vol. VII, p. 538 ; 191,002 (Soc. Ricard Allenet et Cie) relating to the manufacture of butyl chlorides, see Vol. VIII, p. 214.

International Specifications not yet Accepted

195,365. Evaporating Acid Liquids. Appareils et Evaporateurs Kestner, 7, Rue de Toul, Lille, France. International Convention date, March 24, 1922.

In a Kestner evaporating apparatus for use with acid liquor, each evaporating tube is formed of several sections of lead tube provided with a steam casing. The liquid is fed in at the bottom and passes out at the top to a separator. Several such units may be connected in series and the temperature in each unit may be regulated by regulating the steam.

195,366. Hypochlorites and Hypochlorous Acid. Mathieson Alkali Works, Inc., 25, West 43rd Street, Manhattan, New York. Assignees of M. C. Taylor, C. A. Gammal, and R. E. Gegenheimer, 25, West 43rd Street, Manhattan, New York. International Convention date, March 25, 1922.

Chlorine is passed through a solution of sodium bicarbonate, or a suspension of calcium carbonate which are capable of neutralising hydrochloric acid, but not hypochlorous acid. An organic solvent is then added, which is not miscible with water and dissolves the hypochlorous acid but not the chloride.

The extract is then treated with a strong alkali such as sodium or potassium hydroxide or slaked lime to produce a hypochlorite and liberate the solvent. Suitable solvents are carbon tetrachloride, chloroform, ethylene chloride, tetrachlorethane or ether, with a small quantity of methyl, ethyl, isopropyl or butyl alcohol. Alternatively alcohol alone may be used.

195,390. ACTIVE CHARCOAL. Farbenfabriken vorm. F. Bayer and Co., Leverkusen, near Cologne, Germany. International Convention date, March 22, 1922.

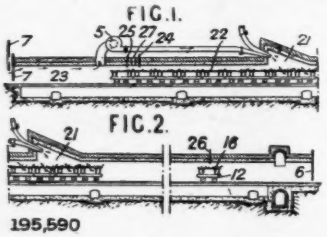
Peat or lignite is finely ground, impregnated with ferric chloride or phosphoric acid in a kneading machine and agglomerated by intrusion through a thread press, using 5 m.m. dies. The agglomerated material is then carbonised.

195,400. SEPARATING GASEOUS MIXTURES. Farbwerke vorm. Meister Lucius and Bruning, Hoechst-on-Main, Germany. International Convention date, March 24, 1922. Addition to 195,098. (See THE CHEMICAL AGE, Vol. VIII, p. 577.)

Specification 195,098 describes the separation of gases by treatment with successive moving layers of activated charcoal. In this invention charcoal layers of different absorptive powers are used, usually in increasing absorptive power. The course of the separation may thus be controlled.

195,590. TUNNEL FURNACES. Soc. Anon. J. Cockerill, Seraing-on-Meuse, Belgium. International Convention date, March 30, 1922.

The furnace is suitable for the roasting, calcining, fritting, and agglomeration of ores, for the manufacture of lime and cement, brick burning, etc. The charge passes first through a preliminary heating zone 6, and then through a burning zone comprising one or more combustion chambers 21 heated

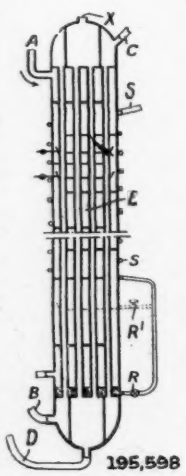


195,590

by flame from gas burners above. The charge then passes through a cooling zone 22, 23, containing a pair of dampers 24, 25. Air is drawn in through the chamber 23 by a fan 5 and delivered to the burners at such a pressure that the flame burns at a distance from the burner. Oxidising or reducing reactions may be effected by controlling the burners. An air port 27 is provided between the dampers, and by the use of an additional damper 26 the pressure in the burning zone may be maintained at that of the atmosphere. The charge is supported on perforated hearths 16 carried by trucks 12, and the hot gases pass through the charge to the space below.

195,598. LIQUEFYING GASES. L'Air Liquide, Soc. Anon, pour l'Etude et l'exploitation des Procédés. G. Claude, 48, Rue St. Lazare, Paris. International Convention date, March 30, 1922.

Coal or coke oven gases are dried and freed from sulphur compounds, benzol, and carbon dioxide and passed through a pipe A to a heat exchanger E. Hydrogen previously separated is circulated in counter-current from the pipe B to the pipe C, and nitrogen, carbon monoxide and methane, also previously separated, pass upwards from the pipe D, to the pipe X. The fresh gases are cooled, and the easily condensible gases with some methane are liquefied and drawn off through a valve R. This mixture is reheated by passing round a coil S. The condensates may be fractionally collected by substituting several draw off valves at different levels, for the valve R.



195,598

195,597. CRYSTALLISING SALTS. Aktieselskapet de Norske Saltverker, 71, Kong Oskarsgate, Bergen, Norway. International Convention date, March 29, 1922.

A mixture of two solutions is supersaturated by evaporation or cooling, and then circulated in a closed cycle through layers of crystals of the two salts, supported on perforated screens, and the salts in solution are crystallised in these layers. Alternatively, a single layer of the mixed crystals may be used, and the two salts afterwards separated according to their specific gravities, or the mixed crystals of the two salts may be of different sizes and may then be separated by screening.

195,600. DYES. Farbwerke vorm. Meister, Lucius and Brüning, Hoechst-on-Main, Germany. International Convention date, April 1, 1922. Addition to 193,866. (See THE CHEMICAL AGE, Vol. VIII, p. 494.)

Azo dyes are obtained by coupling diazo compounds from halogenated toluidines or halogenated alkyloxy-, aryloxy-, or aralkyloxy-anilines or homologues or substitution products with a non-halogenated *p*-toluidide, *p*-alkyloxy-anilide, *p*-aryloxy-anilide, or *p*-aralkyloxy-anilide of 2 : 3-oxynaphthoic acid. As examples, dyestuffs are produced in substance from 5-chlor-2-toluidine and 2 : 3-oxynaphthoic-4-anisidide, or 4-chlor-2-anisidine and 2 : 3-oxynaphthoric-4-toluidide; and printing and padding baths containing as diazo components 4- or 5-chlor-2-toluidine and 4-chlor-2-anisidine, and as second components the *p*-anisidide and *p*-toluidide of 2 : 3-oxynaphthoic acid.

LATEST NOTIFICATIONS.

197,932. Process for manufacturing a dye from dioxyperylene. H. Pereira. May 18, 1922.

197,940. Manufacture of new mordant dyestuffs. Durand and Huguenin Akt.-Ges. May 20, 1922.

197,966. Process for the production of colloidal solutions and re-soluble dried residues from irreversible colloids. Oderberger Chemische Werke Akt.-Ges. May 19, 1922.

Specifications Accepted, with Date of Application

173,225. Resin, Manufacture of. Barrett Co. December 22, 1920.

183,419. Vat dye, Production of. National Aniline and Chemical Manufacturing Co., Inc. July 20, 1921.

188,296. Lac resin, Manufacture of. Bhopal Produce Trust, Ltd. October 29, 1921.

197,353. Fractional separation of vapours and gases. Plauson's (Parent Co.), Ltd. (*H. Plauson.*) December 7, 1921.

197,357. Solid fuels, Concentration or improvement of. T. Rigby. January 4, 1922.

197,372. Obtaining light hydrocarbon distillates. D. W. Hovey. February 6, 1922.

197,389. Petroleum, Method of refining. P. T. Sharples. February 9, 1922.

197,429. Purification of fats and oils and the treatment of dust-like substances with solvents. H. Bollmann. February 17, 1922.

197,433. Making ore or fuel briquettes or the like, and apparatus therefor. Andrews and Co., Ltd., and Sir A. M. Duckham. February 18, 1922.

197,494–5. Cracking hydrocarbons, Process and apparatus for. S. L. Gartlan and A. E. Gooderham. April 4, 1922.

197,573. Zirconium alloys and processes for making same. E. C. R. Marks. (*Electro Metallurgical Co.*) June 22, 1922.

197,576. Cracking oils, Process and apparatus for. A. J. Mahan and T. J. Lynch. June 26, 1922.

Applications for Patents

Auld, S. J. M. Treatment of hydrocarbons. 13,879. May 25.

British Cellulose & Chemical Manufacturing Co., Ltd., and Ellis, G. H. Treatment of cellulose-acetate products. 13,444. May 22.

Broomfield, H., and Russell, R. Manufacture of asbestos or asbestos products. 13,706. May 24.

Cosway, H. C., Douse, D. F., Shortt, A., and United Alkali Co., Ltd. Manufacture of methyl chloride and ethyl chloride. 13,835. May 25.

Croad, R. B., and Higgins, E. B. Manufacture of varnishes and anti-fouling compositions. 13,633. May 23.

Karpen & Bros., S., and Wade, H. Manufacture of phenolic condensation products. 13,753. May 24.

Karpen & Bros., S., and Wade, H. Manufacture of esters. 13,754. May 24.

Lever Bros., Ltd., Refining oils and fats. 13,763. May 24.

Oderberger Chemische Werke Akt.-Ges. Production of colloidal solutions and re-soluble dried residues from irreversible colloids. 13,502. May 22. (Austria, May 19, 1922.)

Planters Margarine Co., Ltd., and Townsend, C. S. Preparation of comminuted waxes and fats. 13,779. May 24.

Titanium Pigment Co., Inc. Treatment of titaniferous material. 13,755. May 24. (United States, November 8, 1922.)

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to* THE CHEMICAL AGE, *and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers ; those interested in close variations in prices should study the market report.

London, May 30, 1923.

THE chemical trade has been more active this week, and the demand has broadened considerably. Quotations continue firm on the whole, with supplies in sight on the light side.

Export inquiry has been somewhat better, and fair business has resulted.

General Chemicals

ACETONE has been in good request, and prices firm.

ACID ACETIC.—Price well maintained, and supplies somewhat short.

ACID CITRIC.—Is only in small request, and price nominally unchanged.

ACID FORMIC.—In fair demand, without change in value.

ACID OXALIC.—Has been fairly well called for, and the price is moderately firm.

ACID TARTARIC.—Unchanged.

ARSENIC.—Is nominally unchanged, but the demand, especially on export account, has fallen off.

BARIUM CHLORIDE.—Continues weak, and in poor request.

CREAM OF TARTAR.—Quite active, and price very firm.

FORMALDEHYDE.—Continues very firm, but only in moderate demand.

LEAD ACETATE.—Has been very active, and supplies are light.

METHYL ALCOHOL.—Has been in brisk inquiry, and prices firm.

POTASSIUM CARBONATE.—While being firm, only moderate business has resulted.

POTASSIUM CAUSTIC.—Unchanged.

POTASSIUM PERMANGANATE.—Tends to become slightly easier, but is in fair request.

POTASSIUM PRUSSIATE.—Has been in much better demand at last quoted figures.

SODIUM ACETATE is higher, and in very light supply.

SODIUM BICHROMATE.—Is firm, at British makers' figures.

SODIUM HYPOSULPHITE.—Has been in better request, and prices firm.

SODIUM NITRITE.—Only moves slowly into consumption, and price inclined to be slightly easier.

SODIUM PHOSPHATE.—More active, and firm in price.

SODIUM PRUSSIATE.—Continues quiet in the absence of export demand.

SODIUM SULPHIDE.—Better business has resulted, but price still tends slightly in buyers' favour.

ZINC OXIDE.—Is only in moderate request, and nominally unchanged in value.

Pharmaceutical Chemicals

ACETYL SALICYLIC ACID continues in steady demand at last prices.

AMIDOL.—Demand improving, slightly lower prices have been accepted for quantity in original bulk packages.

BARBITONE has advanced sharply. Supplies are difficult to obtain even at the higher level.

BROMIDES have been in fair request. Isolated parcels offering from Continental sources at varying prices, due to the break in the German exchange. Makers' prices, however, are maintained at previous rates.

GUAIACOL CARBONATE.—The demand is light, stocks cannot be replaced at present level, and the tendency is consequently upward.

HEXAMINE.—Active but irregular.

PHENACETIN is in good demand and firm. The cheaper parcels are being rapidly disposed of, and a further advance seems likely.

PHENAZONE.—In moderate demand. Price unchanged.

PHENOLPHTHALEIN has advanced considerably. The demand exceeds the supply, and stocks cannot be replaced even at the current rate.

RESORCINE.—Active and firm.

SALICYLIC ACID.—Prices are well maintained. Makers report a good demand, and forward sales are considerable.

VANILLIN tends in buyers' favour.

Coal Tar Intermediates

Trade in this section has been slightly better and values are on the whole maintained. The volume of business passing however, leaves room for considerable improvement.

ALPHA NAPHTHOL has been inquired for on export account, and some home trade is passing.

ALPHA NAPHTHYLAMINE is firm, and a good home business has been done.

ANILINE OIL is quiet.

DIMETHYLANILINE.—Some home inquiry has been received.

DINITROCHLORBENZOL has been in fair request, especially for export.

DIPHENYLAMINE.—Export inquiries are reported.

METAPHENYLENEDIAMINE.—Some fair home business has been placed.

NAPHTHIONIC ACID is quiet and steady.

NITRO BENZOL maintains its value, but only small business is reported.

PARANITRANILINE.—Foreign buyers are interested.

Coal Tar Products

The market generally has maintained a somewhat easier tone during the last week, and there are indications that slightly lower prices are to be expected.

90% BENZOL is worth 1s. 7d. per gallon on rails.

PURE BENZOL is quiet, and is quoted at 2s. 1d. per gallon on rails in the North, and 2s. 4d. to 2s. 5d. per gallon in the South.

CREOSOTE OIL is again easier, and is being freely offered at 8¼d. per gallon on rails in the North, and the price in the South is 8¾d. to 9d. per gallon.

CRESYLIC ACID is steady at 2s. 2d. per gallon on rails for the pale quality 97/99%, while the dark quality 95/97% is worth 1s. 10d. to 1s. 11d. per gallon.

SOLVENT NAPHTHA is steady at 1s. 4d. per gallon.

HEAVY NAPHTHA is also fairly firm at 1s. 6d. per gallon on rails.

NAPHTHALENES are somewhat easier, the cheaper qualities being worth about £7 to £8 10s. per ton, while the better qualities are being quoted at £11 to £12 per ton.

PITCH.—A little inquiry has been received during the past few days for next season's delivery, and prices are approximately 120s. to 130s., f.o.b., London; 110s. to 120s. f.o.b., East Coast and West Coast ports.

Sulphate of Ammonia

SULPHATE OF AMMONIA.—The position remains unchanged.

[*Current Market Prices on following pages.*]

The Chile Nitrate Market

THE Anglo-South American Bank, Ltd., has received the following message from Valparaiso dated May 24 :—

The meeting of the Nitrate Producers' Association to consider the question of the renewal of the Association for a further period was postponed until June 1. The exchange market is steady, and the rate has improved during the week, having fallen to 35·40 on the 18th inst., and again to 35·90 to-day, the sterling value of the peso at this level being 6¾d., as against 6¾d. a week ago. Sales of nitrate during the past week have again been of large dimensions, totalling 777,620 metric quintals, bringing the total sales to date for 1923–24 delivery up to 4,184,084 metric quintals, the quantities arranged for various delivery dates being as follows :—

1923.	Metric quintals.	1923.	Metric quintals.
July	1,500,000	October	68,072
August	1,750,000	November.....	30,480
September	1,515,212	December	20,320

Current Market Prices

General Chemicals

	Per	£	s.	d.		£	s.	d.
Acetic anhydride, 90–95%	lb.	0	1	4	to	0	1	5
Acetone oil	ton	90	0	0	to	95	0	0
Acetone, pure	ton	121	0	0	to	125	0	0
Acid, Acetic, glacial, 99–100%	ton	69	0	0	to	70	0	0
Acetic, 80% pure	ton	50	0	0	to	51	0	0
Acetic, 40% pure	ton	25	0	0	to	26	0	0
Arsenic, liquid, 2000 s.g.	ton	88	0	0	to	90	0	0
Boric, commercial	ton	50	0	0	to	55	0	0
Carbolic, cryst. 39–40%	lb.	0	1	8	to	0	1	9
Citric	lb.	0	1	10	to	0	1	10½
Formic, 80%	ton	52	10	0	to	53	0	0
Hydrofluoric	lb.	0	0	7½	to	0	0	8½
Lactic, 50 vol.	ton	41	0	0	to	43	0	0
Lactic, 60 vol.	ton	43	0	0	to	44	0	0
Nitric, 80 Tw.	ton	27	0	0	to	28	0	0
Oxalic	lb.	0	0	6½	to	0	0	6¾
Phosphoric, 1.5	ton	35	0	0	to	38	0	0
Pyrogallic, cryst.	lb.	0	5	9	to	0	6	0
Salicylic, Technical	lb.	0	1	9	to	0	2	0
Sulphuric, 92–93%	ton	6	0	0	to	7	0	0
Tannic, commercial	lb.	0	2	3	to	0	2	9
Tartaric	lb.	0	1	5	to	0	1	5½
Alum, lump	ton	12	10	0	to	13	0	0
Chrome	ton	28	0	0	to	29	0	0
Alumino ferric	ton	7	0	0	to	7	5	0
Aluminium, sulphate, 14–15%	ton	8	10	0	to	9	0	0
Sulphate, 17–18%	ton	10	10	0	to	11	0	0
Ammonia, anhydrous	lb.	0	1	6	to	0	1	8
.880	ton	32	0	0	to	34	0	0
.920	ton	22	0	0	to	24	0	0
Carbonate	lb.	0	0	4	to	0	0	4½
Chloride	ton	50	0	0	to	55	0	0
Muriate (galvanisers)	ton	35	0	0	to	37	10	0
Nitrate (pure)	ton	35	0	0	to	40	0	0
Phosphate	ton	68	0	0	to	70	0	0
Sulphocyanide, commercial 90%	lb.	0	1	1	to	0	1	3
Amyl acetate	ton	175	0	0	to	185	0	0
Arsenic, white powdered	ton	73	0	0	to	75	0	0
Barium, carbonate, Witherite	ton	5	0	0	to	6	0	0
Carbonate, Precip.	ton	15	0	0	to	16	0	0
Chlorate	ton	65	0	0	to	70	0	0
Chloride	ton	16	0	0	to	16	10	0
Nitrate	ton	33	0	0	to	35	0	0
Sulphate, blanc fixe, dry	ton	20	10	0	to	21	0	0
Sulphate, blanc fixe, pulp	ton	10	5	0	to	10	10	0
Sulphocyanide, 95%	lb.	0	0	11	to	0	1	0
Bleaching powder, 35–37%	ton	10	10	0	to	11	0	0
Borax crystals	ton	28	0	0	to	32	0	0
Calcium acetate, Brown	ton	11	10	0	to	12	0	0
Grey	ton	19	15	0	to	20	0	0
Carbide	ton	16	0	0	to	17	0	0
Chloride	ton	5	15	0	to	6	0	0
Carbon bisulphide	ton	35	0	0	to	40	0	0
Casein technical	ton	100	0	0	to	105	0	0
Cerium oxalate	lb.	0	3	0	to	0	3	6
Chromium acetate	lb.	0	1	1	to	0	1	3
Cobalt acetate	lb.	0	6	0	to	0	6	6
Oxide, black	lb.	0	9	6	to	0	10	0
Copper chloride	lb.	0	1	1	to	0	1	2
Sulphate	ton	27	0	0	to	28	0	0
Cream Tartar, 98–100%	ton	97	10	0	to	100	0	0
Epsom salts (*see* Magnesium sulphate)								
Formaldehyde, 40% vol.	ton	92	10	0	to	95	0	0
Formusol (Rongalite)	lb.	0	2	1	to	0	2	2
Glauber slats, commercial	ton	5	0	0	to	5	10	0
Glycerin crude	ton	65	0	0	to	67	10	0
Hydrogen peroxide, 12 vols.	gal	0	2	2	to	0	2	3
Iron perchloride	ton	28	0	0	to	30	0	0
Sulphate (Copperas)	ton	3	10	0	to	4	0	0
Lead acetate, white	ton	43	0	0	to	45	0	0
Carbonate (White Lead)	ton	45	0	0	to	48	0	0
Nitrate	ton	44	10	0	to	45	0	0
Litharge	ton	45	0	0	to	46	0	0
Lithophone, 30%	ton	22	10	0	to	23	0	0
Magnesium chloride	ton	4	7	6	to	4	10	0
Carbonate, light	cwt.	2	10	0	to	2	15	0
Sulphate (Epsom salts commercial)	ton	6	10	0	to	7	0	0
Sulphate (Druggists')	ton	10	0	0	to	11	0	0
Manganese Borate, commercial	ton	65	0	0	to	75	0	0
Sulphate	ton	50	0	0	to	55	0	0
Methyl acetone	ton	78	0	0	to	80	0	0
Alcohol, 1% acetone	ton	105	0	0	to	110	0	0
Nickel sulphate, single salt	ton	40	0	0	to	41	0	0
Ammonium sulphate, double salt	ton	40	0	0	to	41	0	0
Potash, Caustic	ton	35	0	0	to	36	0	0
Potassium bichromate	lb.	0	0	5¾	to	0	0	6
Carbonate, 90%	ton	31	0	0	to	32	0	0
Chloride, 80%	ton	9	0	0	to	10	0	0
Chlorate	lb.	0	0	4	to	0	0	4½
Metabisulphite, 50–52%	ton	75	0	0	to	80	0	0
Nitrate, refined	ton	43	0	0	to	45	0	0
Permanganate	lb.	0	0	10½	to	0	0	11
Prussiate, red	lb.	0	3	3	to	0	3	6
Prussiate, yellow	lb.	0	1	4½	to	0	1	5
Sulphate, 90%	ton	10	10	0	to	11	0	0
Salammoniac, firsts	cwt.	3	3	0	to	—		
Seconds	cwt.	3	0	0	to	—		
Sodium acetate	ton	25	0	0	to	25	10	0
Arsenate, 45%	ton	45	0	0	to	48	0	0
Bicarbonate	ton	10	10	0	to	11	0	0
Bichromate	lb.	0	0	4½	to	0	0	4¾
Bisulphite, 60–62%	ton	21	0	0	to	23	0	0
Chlorate	lb.	0	0	3½	to	0	0	3½
Caustic, 70%	ton	19	10	0	to	20	0	0
Caustic, 76%	ton	20	10	0	to	21	0	0
Hydrosulphite, powder	lb.	0	1	5	to	0	1	6
Hyposulphite, commercial	ton	10	10	0	to	11	0	0
Nitrite, 96–98%	ton	27	10	0	to	28	0	0
Phosphate, crystal	ton	16	0	0	to	16	10	0
Perborate	lb.	0	1	0	to	0	1	1
Prussiate	lb.	0	0	7¾	to	0	0	8
Sulphide, crystals	ton	10	10	0	to	11	0	0
Sulphide, solid, 60–62 %	ton	16	10	0	to	17	10	0
Sulphite, cryst.	ton	12	10	0	to	13	0	0
Strontium carbonate	ton	50	0	0	to	55	0	0
Nitrate	ton	50	0	0	to	55	0	0
Sulphate, white	ton	6	10	0	to	7	10	0
Sulphur chloride	ton	25	0	0	to	27	10	0
Flowers	ton	11	10	0	to	12	10	0
Roll	ton	11	0	0	to	12	0	0
Tartar emetic	lb.	0	1	2	to	0	1	3
Tin perchloride, 33%	lb.	0	1	1	to	0	1	2
Perchloride, solid	lb.	0	1	3	to	0	1	4
Protochloride (tin crystals)	lb.	0	1	4	to	0	1	5
Zinc chloride 102° Tw.	ton	20	0	0	to	21	0	0
Chloride, solid, 96–98%	ton	25	0	0	to	30	0	0
Oxide, 99%	ton	50	0	0	to	52	0	0
Dust, 90%	ton	50	0	0	to	55	0	0
Sulphate	ton	16	0	0	to	17	0	0

Pharmaceutical Chemicals

Acetyl salicylic acid	lb.	0	3	3	to	0	3	6
Acetanilid	lb.	0	1	6	to	0	1	9
Acid, Gallic, pure	lb.	0	3	0	to	0	3	3
Lactic, 1.21	lb.	0	2	6	to	0	3	0
Salicylic, B.P.	lb.	0	2	2	to	0	2	6
Tannic, leviss	lb.	0	3	4	to	0	3	6
Amidol	lb.	0	8	0	to	0	8	6
Amidopyrin	lb.	0	13	3	to	0	13	6
Ammon ichthosulphonate	lb	0	2	0	to	0	2	3
Barbitone	lb.	1	0	0	to	1	2	6
Beta naphthol resublimed	lb.	0	1	9	to	0	2	0
Bromide of ammonia	lb.	0	0	9	to	0	0	10
Potash	lb.	0	0	8½	to	0	0	9
Soda	lb.	0	0	9	to	0	0	9½
Caffeine, pure	lb.	0	12	0	to	0	12	3
Calcium glycerophosphate	lb.	0	5	9	to	0	6	0
Lactate	lb.	0	2	0	to	0	2	3
Calomel	lb.	0	4	9	to	0	5	0
Chloral hydrate	lb.	0	3	10½	to	0	4	0
Cocaine alkaloid	oz.	0	18	0	to	0	18	6
Hydrochloride	oz.	0	14	9	to	0	15	0
Corrosive sublimate	lb.	0	4	3	to	0	4	6
Eucalyptus oil, B.P. (70–75% eucalyptol)	lb.	0	1	6	to	0	1	6½
B.P. (75–80% eucalyptol)	lb.	0	1	7	to	0	1	7½
Guaiacol carbonate	lb.	0	8	6	to	0	8	9
Liquid	lb.	0	9	6	to	0	10	0
Pure crystals	lb.	0	10	3	to	0	10	6
Hexamine	lb.	0	4	0	to	0	4	3
Hydroquinone	lb.	0	3	6	to	0	3	9
Lanoline anhydrous	lb.	0	0	7	to	0	0	7½
Lecithin ex ovo	lb.	0	18	6	to	1	0	0
Lithi carbonate	lb.	0	9	6	to	0	10	0
Methyl salicylate	lb.	0	2	6	to	0	2	10
Metol	lb.	0	10	6	to	0	11	6
Milk sugar	cwt.	4	10	0	to	4	12	6
Paraldehyde	lb.	0	1	6	to	0	1	9
Phenacetin	lb.	0	6	6	to	0	7	0
Phenazone	lb.	0	7	9	to	0	8	0
Phenolphthalein	lb.	0	6	6	to	0	6	9
Potassium sulpho guaiacolate	lb.	0	5	0	to	0	5	3
Quinine sulphate, B.P.	oz.	0	2	3		—		

	Per	£	s.	d.		£	s.	d.
Resorcine, medicinal	lb.	0	5	6	to	0	5	9
Salicylate of soda powder	lb.	0	2	6	to	0	2	9
Crystals	lb.	0	2	9	to	0	3	0
Salol	lb.	0	2	9	to	0	3	0
Soda Benzoate	lb.	0	2	3	to	0	2	6
Sulphonal	lb.	0	14	6	to	0	15	0
Terpene hydrate	lb.	0	1	9	to	0	2	0
Theobromine, pure	lb.	0	12	0	to	0	12	6
Soda salicylate	lb.	0	7	9	to	0	8	3
Vanillin	lb.	1	3	0	to	1	4	0

Coal Tar Intermediates, &c.

Alphanaphthol, crude	lb.	0	2	0	to	0	2	3
Refined	lb.	0	2	6	to	0	2	9
Alphanaphthylamine	lb.	0	1	6	to	0	1	7
Aniline oil, drums extra	lb.	0	0	9½	to	0	0	10
Salts	lb.	0	0	9½	to	0	0	10
Anthracene, 40–50%	unit	0	0	8½	to	0	0	9
Benzaldehyde (free of chlorine)	lb.	0	3	0	to	0	3	3
Benzidine, base	lb.	0	5	0	to	0	5	3
Sulphate	lb.	0	3	9	to	0	4	0
Benzoic acid	lb.	0	2	0	to	0	2	3
Benzyl chloride, technical	lb.	0	2	0	to	0	2	3
Betanaphthol	lb.	0	1	1	to	0	1	2
Betanaphthylamine, technical	lb.	0	4	0	to	0	4	3
Croceine Acid, 100% basis	lb.	0	3	3	to	0	3	6
Dichlorbenzol	lb.	0	0	9	to	0	0	10
Diethylaniline	lb.	0	4	6	to	0	4	9
Dinitrobenzol	lb.	0	1	1	to	0	1	2
Dinitrochlorbenzol	lb.	0	0	11	to	0	1	0
Dinitronaphthalene	lb.	0	1	4	to	0	1	5
Dinitrotoluol	lb.	0	1	4	to	0	1	5
Dinitrophenol	lb.	0	1	7	to	0	1	9
Dimethylaniline	lb.	0	3	0	to	0	3	3
Diphenylamine	lb.	0	3	9	to	0	4	0
H-Acid	lb.	0	5	0	to	0	5	3
Metaphenylenediamine	lb.	0	4	0	to	0	4	3
Monochlorben ol	lb.	0	0	10	to	0	1	0
Metanilic Acid	lb.	0	5	9	to	0	6	0
Metatoluylenediamine	lb.	0	4	0	to	0	4	3
Monosulphonic Acid (2.7)	lb.	0	5	6	to	0	6	0
Naphthionic acid, crude	lb.	0	2	3	to	0	2	6
Naphthionate of Soda	lb.	0	2	6	to	0	2	9
Naphthylamin-di-sulphonic-acid	lb.	0	4	0	to	0	4	3
Nevill Winther Acid	lb.	0	7	3	to	0	7	9
Nitrobenzol	lb.	0	0	8	to	0	0	8
Nitronaphthalene	lb.	0	1	0	to	0	1	1
Nitrotoluol	lb.	0	0	8	to	0	0	9
Orthoamidophenol base	lb.	0	12	0	to	0	12	6
Orthodichlorbenzol	lb.	0	1	0	to	0	1	1
Orthotoluidine	lb.	0	0	10	to	0	0	11
Orthonitrotoluol	lb.	0	0	3	to	0	0	4
Para-amidophenol, base	lb.	0	8	6	to	0	9	0
Hydrochlor	lb.	0	7	6	to	0	8	0
Paradichlorbenzol	lb.	0	0	6	to	0	0	7
Paranitraniline	lb.	0	2	7	to	0	2	9
Paranitrophenol	lb.	0	2	3	to	0	2	6
Paranitrotoluol	lb.	0	2	9	to	0	3	0
Paraphenylenediamine, distilled	lb.	0	12	0	to	0	12	6
Paratoluidine	lb.	0	5	9	to	0	6	3
Phthalic anhydride	lb.	0	2	6	to	0	2	9
Resorcin, technical	lb.	0	4	0	to	0	4	3
Sulphanilic acid, crude	lb.	0	0	10	to	0	0	11
Tolidine, base	lb.	0	7	3	to	0	7	9
Mixture	lb.	0	2	6	to	0	2	9

Essential Oils and Synthetics

Essential Oils.		£	s.	d.
Anise	c.i.f. 1/10 spot	0	2	0
Bay		0	12	0
Bergamot		0	12	0
Cajaput		0	3	9
Camphor, white	per cwt.	4	0	0
Brown	„	3	15	0
Cassia	harder, c.i.f. 8/3 spot	0	8	6
Cedarwood		0	1	6
Citronella (Ceylon)		0	3	2
(Java)		0	4	0
Clove	easier	0	7	0
Eucalyptus		0	1	8
Geranium Bourbon	very firm	1	10	0
Lavender	„	0	12	6
Lavender spike		0	3	0
Lemon		0	3	0
Lemongrass	quiet per oz.	0	0	2½
Lime (distilled)		0	3	6
Orange sweet (Sicilian)	dearer and very firm	0	12	6
(West Indian)	very firm	0	10	0
Palmarosa	dearer and very firm	0	18	6
Peppermint (American)		0	13	0
Mint (dementholised Japanese)	firmer	0	6	6
Patchouli	dull	1	12	0
Otto of Rose	per oz.	1	4	0
Rosemary		0	1	8
Sandalwood		1	6	0
Sassafras		0	5	0
Thyme	as to quality 2/6 to	0	8	0

Synthetics.			
Benzyl acetate	0	3	0
Benzoate	0	3	0
Citral	0	10	0
Coumarine	0	16	0
Heliotropine	0	7	6
Ionone	1	5	0
Linalyl acetate	1	2	6
Methyl salicylate (dearer)	0	2	9
Musk xylol	0	9	0
Terpeniol	0	3	1

Sir S. W. Royse's Monthly Report

During May, business in the home market has been only moderate, and Lancashire trade in particular has been affected by the Witsuntide holidays. The export demand continues fair, but quantities are mostly small. Prices in some cases have eased, but on the whole values are well maintained. The price of sulphate of copper is a little lower and a good business has been done for home consumption. The call for export has been steady, and the Board of Trade Returns show 7,577 tons shipped last month as against 7,691 tons for April, 1922, making a total of 25,339 tons for the last four months against 23,810 tons for January–April, 1922. Green copperas has been in better request and has realised higher values. There is no change in the position of acetates of lime, supplies being still short, and acetic acid also is scarce with prices well maintained. The demand for acetates of lead and soda has fallen away somewhat, although stocks are not large. Nitrate of lead continues to sell freely. The inquiry for carbonate and caustic potash has lessened and values are slightly lower, though stocks are only moderate. Trade in Montreal potashes is only nominal. The demand for yellow prussiates of potash and soda is small and, with pressure to sell stocks, prices are weaker. White powdered arsenic continues in short supply for near delivery, but, for shipment ahead, foreign makes are offering at lower rates. Tartaric acid has ruled firm with the clearance of second-hand parcels. Cream of tartar is being held for better prices, but stocks are ample for current needs. Citric acid is firmly held, although the demand has not been so active. Bichromates have been selling well, but values are unchanged. Chlorates of potash and soda remain dull, but there has been a better call for nitrite of soda. The price for boracic acid has been reduced £5 per ton, but borax is unchanged. Oxalic acid is in only small demand. The prices of alum and sulphate of alumina have been further reduced to meet Continental competition, but the inquiry is still well below normal. Lump salammoniac and muriate of ammonia have been in steady request for export. Both bleaching powder and white caustic soda have had an improved home trade inquiry and have also been shipped more freely. There is little change to report in the tar products market. Benzols and toluols remain steady. Solvent naphtha is without much inquiry, and prices if anything are lower. The demand for creosote has fallen away and values are showing a downward tendency, consumers being reluctant to buy forward supplies in anticipation of a still further drop in prices. The call for crude carbolic acid is quieter and lower figures are being quoted, but crystals have been selling better. Naphthalenes are showing more activity and prices are firming up, due, no doubt, to the increased demand from abroad for the refined product. Pitch has continued its downward course and little business has been passing. The present conditions are inducing consumers to delay purchasing for next season. In South Wales the position is unchanged. There is nothing new to report in sulphate of ammonia.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to THE CHEMICAL AGE by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.

Glasgow, May 30, 1923.

DURING the past week business in the heavy chemical market has been more satisfactory, a good number of inquiries being received, with a fair proportion resulting in business.

Prices on the whole are steady, with acetic acid firmer if anything, and spot lots of Continental products about the same level as last week. Continental offers for forward delivery are easier, however, and this will no doubt have an early effect on the spot quotations.

Industrial Chemicals

ACID, ACETIC.—Glacial, 98/100%, £61 to £70 per ton; 80% pure, £49 to £50 per ton; 80% technical, £47 to £49 per ton, c.i.f. U.K. ports.

ACID, BORACIC.—Crystal or granulated, £50 per ton; powdered, £52 per ton, carriage paid U.K. stations.

ACID, CARBOLIC.—Ice crystals, unchanged at 1s. 5½d. per lb.

ACID, CITRIC.—Now quoted 1s. 9½d. per lb., ex store.

ACID, FORMIC 80%.—Unchanged at £51 per ton, ex works.

ACID, HYDROCHLORIC.—6s. 6d. per carboy, ex works; in little demand.

ACID, OXALIC.—Offered at 6½d. per lb., ex store.

ACID, SULPHURIC.—144°, £3 15s. per ton; 168°, £7 per ton, ex works, full truck loads. Dearsenicated quality, £1 per ton more.

ACID, TARTARIC.—Price about 1s. 3¾d. per lb., ex wharf, early delivery.

ALUM, LUMP POTASH.—Moderate inquiry. Spot lots, about £12 15s. per ton, ex store. Offered at £11 10s. per ton, f.o.b. U.K. for export.

AMMONIA, ANHYDROUS.—Unchanged at 1s. 6d. per lb., ex station.

AMMONIA, CARBONATE.—Lump, 4d. per lb.; ground, 4¼d. per lb., delivered.

AMMONIA, LIQUID, 880°.—Unchanged at 3½d. per lb., delivered.

AMMONIA, MURIATE.—Grey galvanisers' quality, £32 to £33 per ton. Fine white crystals quoted at £26 10s. per ton, ex wharf.

AMMONIA, SULPHATE.—25¼%, £15 10s. per ton; 25¾ %, neutral, £16 13s. per ton, ex works in buyers' own vehicles, prompt delivery.

ARSENIC, WHITE POWDERED.—Moderate export inquiry. Quoted about £75 per ton.

BARIUM, CARBONATE, 98/100%.—Offered at £16 10s. per ton, ex wharf.

BARIUM, CHLORIDE, 98/100%. Now quoted £13 15s. per ton, c.i.f. U.K., prompt shipment.

BARYTES, FINEST WHITE ENGLISH.—£5 5s. per ton, ex works.

BLEACHING POWDER.—£11 7s. 6d. per ton, ex station, spot delivery. Contracts 20s. per ton less. Offered from Continent at £9 2s. 6d. per ton, c.i.f. U.K.

COPPERAS, GREEN.—Unchanged at about £2 10s. to £2 15s. per ton, f.o.b. U.K.

FORMALDEHYDE, 40%.—£90 to £91 per ton, now asked for spot lots. Quoted £89 per ton, ex wharf, early delivery.

GLAUBER SALTS.—Fine white crystals, offered at £3 15s. per ton, ex store.

LEAD, RED.—English make unchanged at £41 per ton, carriage paid U.K. Italian material about £35 5s. per ton, ex store.

LEAD ACETATE.—Little spot material available; white crystals, £43 to £44 per ton; brown, about £40 to £41 per ton.

LEAD NITRATE.—Quoted £39 per ton, c.i.f. U.K.

MAGNESITE.—Ground calcined English make, £8 10s. per ton, ex station.

MAGNESIUM CHLORIDE.—Offered from Continent at £2 per ton, c.i.f. U.K. Spot lots now quoted £3 2s. 6d. per ton.

MAGNESIUM, SULPHATE (Epsom Salts).—Commercial crystals, £7 per ton; B.P. quality, £8 10s. per ton. Continental Commercial crystals offered at £4 per ton, ex wharf.

POTASH, CAUSTIC, 88/92%.—Now on offer at £32 10s. per ton, ex store. Continental prices easier at about £31 per ton, c.i.f. U.K.

POTASSIUM BICHROMATE.—Unchanged at 5¾d. per lb. delivered.

POTASSIUM CARBONATE.—96/98%, about £33 15s. per ton; 90/92%, £28 10s. per ton, ex store, spot delivery.

POTASSIUM CHLORATE.—Crystals or powdered, quoted 3d. per lb., ex store.

POTASSIUM NITRATE (SALTPETRE).—In little demand, prices about £32 per ton, ex store.

POTASSIUM PERMANGANATE.—B.P. crystals now quoted 11d. per lb. ex store.

POTASSIUM PRUSSIATE (YELLOW).—Spot lots about 1s. 4¾d. per lb., ex store. Offered at 1s. 4d. per lb., ex wharf, early delivery.

SODA, CAUSTIC.—76/77%, £21 7s. 6d. per ton; 70/72%, £19 17s. 6d. per ton; 60/62%, broken, £21 2s. 6d. per ton; 98/99%, powdered, £24 15s. per ton, all ex station, spot delivery.

SODIUM ACETATE.—Inclined to be higher at £25 per ton, ex store.

SODIUM BICARBONATE.—Refined recrystallised quality, £10 10s. per ton, ex quay. M.W. quality 30s. per ton less.

SODIUM BICHROMATE.—Unchanged at 4½d. per lb., delivered.

SODIUM CARBONATE.—Soda crystals, £5 to £5 5s. per ton, ex quay or station. Alkali 58%, £8 16s. per ton, ex quay or station.

SODIUM CHLORATE.—Offered at 2¾d. per lb., ex wharf.

SODIUM HYPOSULPHITE.—Commercial crystals offered at £8 5s. per ton, c.i.f. U.K.; spot lots about £9 15s. per ton, ex wharf; pea crystals quoted £15 10s. per ton, ex store.

SODIUM NITRATE.—Refined, 96/98% quality, £13 7s. 6d. per ton, f.o.r. or f.o.b. U.K.

SODIUM NITRITE, 100%.—Now quoted £26 10s. to £28 10s. per ton, according to quantity.

SODIUM PRUSSIATE (YELLOW).—Offered at 7½d. per lb. c.i.f. U.K. Spot lots about 8d. per lb., ex store.

SODIUM SULPHATE (SALTCAKE 95%).—£4 per ton, ex station, for home consumption. Higher prices for export.

SULPHUR.—Flowers, £10 per ton; roll, £9 per ton; rock, £9 per ton; ground, £8 per ton. Prices nominal.

TIN, CRYSTALS.—Unchanged at 1s. 4d. per lb.

ZINC, SULPHATE.—English white commercial, £14 per ton. Continental about £12.

NOTE.—The above prices are for bulk business and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

ALPHA NAPHTHYLAMINE.—In good demand. Price firm at 1s. 6½d.

BENZYL CHLORIDE.—Some inquiries. Price quoted, 1s. 9d. per lb., delivered, drums returnable.

BETA NAPHTHOL.—Home inquiries. Price quoted 1s. 1d. per lb., delivered.

NAPHTHALENE, FLAKE.—Supplies are offered at £16 per ton, delivered, in casks, and £15 per ton, delivered, in bags.

NITRONAPHTHALENE, REFINED.—Small inquiries. Price 1s. per lb., delivered.

PARADICHLORBENZOL.—Several inquiries. Price quoted, 9d. per lb., delivered.

PARANITRANILINE.—Good demand for export and home trade. Price 2s. 7d. per lb., f.o.b. or carriage paid.

Demand for Creosote in Spain

H.M. Consul at Madrid (Mr. D. J. Rodgers) reports that the North Railway Co. of Spain are desirous of entering into communication with British producers of creosote. The company consume annually 2,500 tons of creosote for their sleepers, and they wish to know the present prices f.o.b. English port, and also c.i.f. Bilbao or Santander. Those interested in this inquiry should communicate (in Spanish if possible) with Sr. Ingeniero del Material Fijo, Cia de los Caminos de Hierro del Norte de España, Vias y Obras, Madrid. Advice should be given at the same time to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1, quoting reference 8102/F.L./C.C.

Manchester Chemical Market

(From our own Correspondent.)

Manchester, May 31, 1923.

There has been little activity in the chemical market here this week. Buying operations have been restricted and have been confined to small parcels, though the leading heavy chemicals still enjoy a fairly good home and export demand. Continental business shows no sign of improvement, overseas trade being chiefly on account of the Dominions. On the whole, prices are maintained at recent levels, though in several instances a perceptible shading of quotations has to be reported.

Heavy Chemicals

Caustic soda maintains its activity on home and foreign account; prices for home consumption are steady at from £19 for 60 per cent. to £21 10s. per ton for 76/77 per cent. material. Bleaching powder is also one of the active sections of the market at £11 7s. 6d. per ton. Soda crystals are rather quiet but steady at £5 5s. per ton delivered. Saltcake is selling fairly freely at £4 10s. per ton. Sodium sulphide keeps very dull at £15 per ton for 60–65 per cent. concentrated solid and £9 for crystals. Glauber salts are steady at £4 per ton, but little business is being put through. Bicarbonate of soda is steady, but only in moderate demand at £10 10s. per ton delivered to home users. Alkali is still being steadily called for for home and foreign consumption; 58 per cent. material keeps firm at £7 12s. 6d. per ton to home users. Hyposulphite of soda is quiet at £15 per ton for photographic crystals and £10 for commercial. Nitrite of soda is very firm at £27 per ton, but only a moderate amount of business is being done. Phosphate of soda is quiet and easier at £14 per ton. Chlorate of soda is firm and in good inquiry at 2¾d. per lb. Prussiate of soda is still inactive, and supplies are now obtainable at round 7½d. per lb. Bichromate of soda is in moderate request at 4½d. per lb. Acetate of soda is very firm at £25 per ton, a steady demand being met with.

Caustic potash is steady and in fair demand at £33 per ton for 88–90 per cent. Carbonate of potash is a shade easier at £32 per ton for 96–98 per cent. material and £29 for 90–92 per cent. Bichromate of potash is maintained at 5¾d. per lb., and is in moderate inquiry. Yellow prussiate of potash is quiet and easy at 1s. 4d. per lb. Chlorate of potash is fairly active at 3d. to 3¼d. per lb. Permanganate of potash is steady at 10d. per lb., supplies being readily taken up.

Sulphate of copper is in quietly steady demand for export at £25 10s. to £26 per ton, f.o.b. Arsenic is still in short supply, and though the foreign demand is less pressing, prices are firm at round £75 per ton for white powdered, Cornish makes. Commercial Epsom salts are steady at £4 10s. per ton for foreign and £6 10s. for British makes, with a fair volume of business passing; magnesium sulphate, B.P., is unchanged at £7. Acetate of lime is a very strong section, and with supplies scarce prices are now £22 for grey and £10 10s. per ton for brown. Nitrate of lead is rather neglected at £43 per ton. White sugar of lead is firmly maintained at £43 per ton, with brown on offer at £42.

Acids and Tar Products

Tartaric and citric acids are rather quiet at the moment, but there is little change in prices. Tartaric is quoted at 1s. 3¾d. to 1s. 4d. per lb., and citric, B.P. crystals, at 1s.9d. Acetic acid is firm and in fair demand at £70 for glacial and £48 per ton for 80 per cent. technical. Oxalic acid is still dull and easy at about 6¼d. per lb.

Pitch is now nominally between £6 10s. and £7 per ton, f.o.b. Manchester, with only a restricted foreign demand. Carbolic acid crystals are quiet but unchanged at about 1s. 5d. per lb., with crude, 60 per cent., quoted at 3s. 6d. per gallon. Benzol is inactive at 1s. 7d. per gallon. Solvent naphtha is quiet but steady at 1s. 6d. to 1s. 7d. per gallon. Creosote oil is in moderate demand at 9d. per gallon. Naphthalenes are firm, flake being quoted at £21 and crude at from £8 to £13, according to quality.

Change of Address

Hopkins, Ellis and Co., Ltd., traders in fine and heavy chemicals, announce that they have removed from Salisbury House, London Wall, to 107, Fenchurch Street, London, E.C.3. The telephone number is now "Avenue" 4089.

Brunner, Mond and Co., Ltd.

The annual ordinary general meeting of Brunner, Mond and Co., Ltd., was held at the Midland Adelphi Hotel, Liverpool, on Friday, May 25. Mr. Roscoe Brunner (chairman of directors), in moving the adoption of the report, said that, as he had ventured to hope, they had had a better year than the previous one. "Regarding our work in progress," he said, "we are always improving our plants, but ever with a very jealous eye, to see that the proposed expenditure is justified by the saving that is looked for. The Wallerscote works are proceeding at the most economic speed. They are an ammonia soda works close to Winnington, which will be economically and efficiently managed from our head office. The erection of the Billingham works (Synthetic Ammonia and Nitrates, Ltd.) has been delayed by more than the three months which the trouble in the engineering trade lasted. Much of the engineering in connection with those works is new to Great Britain, and we have met with a number of difficulties which, happily, have been surmounted. Those works are now making rapid progress, and we are greatly pleased with the work of the very capable and efficient staff in charge of them."

It was resolved to offer at a price to be fixed, but not below par, shares not exceeding 100,000 to the staff and workpeople. The chairman described this as a real scheme of co-partnership. Human nature being what it was, the argument was unanswerable that a man would do better work if his work directly benefited himself. Labour leaders should welcome increases in profits and capital of employing companies, because it led to the employment of more men.

Recent Litigation

The chairman also said he had been asked by several shareholders for information about the recent litigation with the Manchester Ship Canal. He gave an outline of the history of the trouble originating with an ambiguous clause inserted in the Manchester Ship Canal Act with the object of protecting traders on the River Weaver. He also referred to the efforts which had been put forth at different stages of the dispute to obtain a settlement. The traders on the Weaver had asked for nothing more than they had in pre-Ship Canal days, but they would not be satisfied with anything less. They made a substantial offer towards a settlement of the claim of the Ship Canal for back tolls, but settlement was refused by the Ship Canal Company, and the case went to the Court of Appeal. Here the decision went in favour of the Ship Canal Company, and once again, in the interval between the hearing of the Court of Appeal and the further appeal to the House of Lords, they (the Weaver traders) tried their best to arrive at an agreement, but negotiations broke down because the Canal Company declined to waive their claim for back tolls. The Weaver traders had gained from the House of Lords a declaration that an access did not mean a gutter without width, but meant a channel of proper curvature and width. The main issue in the whole of the three trials had been whether the party responsible for providing and keeping that access should also be responsible for the buoying and lighting of the channel. The Lords had decided that, upon the law as it stood, the Ship Canal Company, though they had to provide the access, had no duty to define it. There was, however—said Mr. Brunner—another Appeal Court, and if the judges said this was the law then justice demanded that Parliament should alter it. He had only to add that the whole of the company's liabilities under the judgment in the case had been provided for in the accounts under review, and not by the amount it was proposed to put to the suspense account.

British Fine Chemical Prices

Mr. W. J. U. Woolcock, general manager of the Association of British Chemical Manufacturers, has contributed an article to the special "Reconstruction" section of this week's *Manchester Guardian Commercial*, in which he states that a year ago a comparison between the current price list of a British firm (manufacturing fine chemicals) and the pre-war list of an equally well-known German firm showed that the British prices were then only 29 per cent. higher than the pre-war German prices. Since that time further reductions in price have been made, and to-day British prices are very little higher than German pre-war prices.

Company News

THE LAUTARO NITRATE CO., LTD.—The annual general meeting will be held at Winchester House, Old Broad Street, London, at 11.30 a.m., on Tuesday, June 5.

PREMIER PORTLAND CEMENT CO. (RHODESIA).—It is announced that this company has paid a further dividend of 10 per cent.

VIROL, LTD.—The directors have declared a dividend of 20 per cent. on the ordinary shares for the year to March 31 last. This is the highest dividend yet paid by the company.

BRUNNER, MOND AND CO., LTD.—By resolution at the annual meeting, held at Liverpool on May 25, it was decided to offer, at a price to be fixed, but not below par, shares not exceeding 100,000, to the staff and workpeople.

ANGLO-EGYPTIAN OILFIELDS, LTD.—The directors have decided to recommend to the general meeting to be held on June 15, a dividend on the "B" shares for the year 1922, of 12½ per cent., less tax. For 1921 the dividend on the "B" shares was 15 per cent.

THE INTERNATIONAL NICKEL CO.—The annual meeting of the stockholders will be held at the office of the company, at Oak Street, Bayonne, New Jersey, on Tuesday, June 19, for the purpose of electing five directors to hold office for three years and for the transaction of such other business as may come before the meeting.

BURMAH OIL CO.—A final dividend of 4s. per share on the ordinary shares is recommended, making 6s. per share (30 per cent.), free of income tax, for 1922. The profits for the year, after providing for all charges, income tax, etc., amounted to £2,115,823, out of which the directors have transferred £200,000 to general reserve and £20,000 to insurance reserve, leaving £335,062 to be carried forward.

BARRENECHEA NITRATE CO.—For 1922 the year's trading, after providing for bonus on five-year notes, stoppage, and administration expenses, shows a loss of £4,901, which has been carried to debit of profit and loss account, leaving a credit of £4,742, from which it is proposed to pay a dividend of 10 per cent., less tax. The annual meeting will be held at 27, Leadenhall Street, London, E.C., on June 12, at 2 p.m.

A. B. FLEMING AND CO.—The report for the year ended April last states that the amount at the credit of profit and loss account is £36,498, which includes £9,846 brought forward. The directors recommend that there be carried to new buildings and plant account £8,000, payment of dividend of 15 per cent., of which 5 per cent. (actual) was paid in November last, £18,000, balance forward, £10,498. The dividend for the previous year was the same.

NOBEL INDUSTRIES, LTD.—The directors state that they have now received particulars of the results of the constituent and associated companies for the year 1922, which show that there has been a substantial improvement on the previous year, and enables them to declare a dividend on the ordinary shares at the rate of 7 per cent., less tax at 5s. 3d. in the £, payable on July 2. After this distribution (which they propose in due course to recommend as final for 1922) there will be a substantial balance, and the recommendations to be made to the shareholders for its appropriation will include writing off the remainder of note issue cost account, £149,000, an addition of £50,000 to the special investment reserve account, and an addition to the balance (£463,349) carried forward from December, 1921. The annual general meeting will be held in September.

BRITISH OIL AND CAKE MILLS.—Presiding at the annual meeting on Thursday, May 24, Mr. John W. Pearson, chairman and managing director, said that although the actual trading profit earned showed a reduction of about £27,000, the distribution to the shareholders was on the same basis as that of the previous year. The reserve account remained at £950,000, in addition to which there was a substantial appreciation in the investment in Government stocks of nearly £200,000. Of the company's allied businesses the manufacture of margarine continued to show very poor results, and this appeared to be the experience of most people engaged in that trade. On the other hand, their soap factory was proving to be a profitable undertaking and the output was now four times as heavy as it was a year ago. Their new Greenock mill, built on the finest site of any oil mill in the United Kingdom, was now approaching completion, and would be ready to start in August.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

LOCALITY OF FIRM OR AGENT.	MATERIAL.	REF. No.
Los Angeles ...	Ores, paints, chemicals, etc.	709
Denmark	Blue vitriol and copperas.	694
Belgium	Paints, varnishes, enamels.	692

Tariff Changes

CANADA.—In the present Canadian budget provision is made for a 10 per cent. discount on British goods imported direct in cases where the *ad valorem* duty exceeds 15 per cent.

POLAND.—The surtax on imports has been fixed at 9,900 per cent. (payable in paper currency) for the following:—ammonium sulphate; nitric acid; nitrose; cellulose. At 49,900 per cent. for the majority of heavy and fine chemicals, particulars being obtainable from the *Board of Trade Journal*, May 24. On ammonium nitrate, chloride of lime, sulphide of soda, calcium acetate acetone, acetic acid, pure colourless carbolic acid and sulphuric ether for the manufacture of artificial silk the import duty is 119,900 per cent. *ad valorem* (payable in paper currency).

Contracts Open

Tenders are invited for the following articles. The latest dates for receiving tenders are, when available, given in parentheses:

BULGARIA.—Linseed oil. A public adjudication of tenders will be held on June 15. Further particulars from the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. Reference No.10754/F.E./C.C./2.

EDINBURGH (June 16).—Disinfectant liquid soap and disinfectant fluid. Forms of tender, etc., from Education Offices, Castle Terrace.

Catalogues Received

AUTOMATIC AND ELECTRIC FURNACES, LTD.—The Wild-Barfield patent electric furnace for hardening stainless steel cutlery is described in an illustrated folder issued by this firm from Elecfurn Works, 173–175, Farringdon Road, London, E.C.1.

RONALD TRIST AND CO., LTD.—A small booklet is issued by this firm describing the "Raybeam" electric gauge glass illuminator, which is a simple device for illuminating the water-level in a boiler gauge glass, and overcomes the well known difficulty of reading this. The address of the firm is 12, Clipstone Street, Great Portland Street, London, W.1.

HARDINGE COMPANY.—We have received catalogue No. 13, section 1, from the above New York firm, from their London office, 11, Southampton Row, W.C.2. This contains some thirty pages of illustrated descriptive matter dealing with the Hardinge conical mill, its construction and applications to various industries such as in pulverising fuel, fertilisers, in metallurgy and all cases where grinding is required.

H. A. PRAGER.—We have received from the above-named chemical engineer a small catalogue descriptive of various types of meters for registering gas flow. These are based on a very simple scientific principle and may be inserted in any part of a pipe-line conveying steam, air, or gas. The instruments themselves contain few parts, and are not liable to derangement. The address of Mr. Prager is 351, Brixton Road, London, S.W.9.

THOS. W. WARD, LTD.—We have received from this firm, of Silvertown, London, E.16, an illustrated booklet describing various second-hand boilers, condensers, cooling towers, electrical generators, tanks, and other fittings for works and power houses. The number of this list is SK/140 and most of the material described in it has been in use at the Hampstead Electricity Works. We have also received from the same firm lists dealing with new bright drawn and black steel bars, etc., in various sizes and sections.

THE BRITISH ALIZARINE COMPANY LTD.

Manchester London Glasgow

Manufacturers of Alizarine Dyestuffs

ALIZARINE RED (all shades)

ALIZARINE BLUES (soluble and insoluble)

ALIZARINE BORDEAUX

ALIZARINE CYANINE

ALIZARINE GREEN (soluble and insoluble)

ALIZARINE ORANGE

ALIZARINE RED S. POWDER

ALIZARINE BLUE BLACK

ALIZARINE (MADDER) LAKES (of all qualities)

ALIZARINE MAROON

ALIZUROL GREEN (Viridine)

ANTHRACENE BROWN

ALIZANTHRENE BLUE

ALIZANTHRENE BROWN

ALIZANTHRENE YELLOW

Other fast colours of this series in course of preparation

Anthraquinone, Silver Salt and all intermediates of this series

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CHROME TANNING and other Chrome Compounds

TELEPHONES
663 Trafford Park, MANCHESTER
560 EAST LONDON
2667 DOUGLAS, GLASGOW

TELEGRAMS
BRITALIZ MANCHESTER
BRITALIZ LONDON
BRITALIZ GLASGOW

All communications should be addressed to

The British Alizarine Co., Ltd.
Trafford Park, Manchester

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Receivership

JOYCE (T. G.), LTD. (R., 2/6/23.) J. Aylieff, of Queen's College, Paradise Street, Birmingham, was appointed receiver and manager, by order of Court dated May 11, 1923.

Mortgages and Charges

*[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]*

BAILEY (FRANK), LTD., Halifax, dyers and finishers.—(M., 2/6/23.) Registered May 14 (by order on terms), £13,650 debentures, secured by trust deed, dated January 29, 1923; general charge (except certain properties comprised in 2nd schedule to deed). *Nil. April 3, 1923.

EXPRESS DYEING AND CLEANING CO., LTD., London, W. (M., 2/6/23.) Registered May 14, £1,500 (not ex.) charge, to bank, charged on Express Works, Northfield Road, Ealing.

HULL LUBRICATING OIL CO., LTD. (M., 2/6/23.) Registered May 15, £400 debentures; general charge.

NATIONAL FEDERATION OF LAUNDERERS, LTD., London, W. (M., 2/6/23.) Registered May 16, £6,000 debentures; general charge.

STAPLETON (P.), LTD., Mountsorrel, dyers. (M., 2/6/23.) Registered May 10, mortgage, to bank; charged on properties at Main Street, Mountsorrel.

WAITE'S BRITISH CHEMISTS, LTD., North Shields. (M., 2/6/23.) Registered May 15, £1,800 mortgage, to Building Society; charged on 27, Bedford Street, North Shields. *£1,750. May 4, 1922.

WILLOW DYE WORKS, LTD. (late WILLOW LAUNDRY DYEING AND DRY CLEANING CO., LTD.), Leicester. (M., 2/6/23.) Registered May 18, charge, to bank; charged on 204 and 206, Willow Street, Leicester. *£1,300. June 17, 1922.

Satisfactions

COCKROFT (FRED), LTD., Leeds, manufacturing chemists. (M.S., 2/6/23.) Satisfaction registered May 15, £5,750, registered October 11, 1920.

WAITE'S BRITISH CHEMISTS, LTD., North Shields. (M.S., 2/6/23.) Satisfaction registered May 15, £1,750, registered December 31, 1920.

London Gazette

Company Winding Up

HERCULIN GLUE AND COMPOUNDS CO., LTD., 9 and 11, Richmond Road, Twickenham, Middlesex. (C.W.U., 2/6/23.) Last day for receiving proofs for intended dividend, June 9. Liquidator, Thomas Gourlay, Official Receiver and Liquidator, 29, Russell Square, London, W.C.1.

Notice of Dividend

BROWN, John, and HALL, Reginald, carrying on business in co-partnership at Hadfield Works, Gelderd Road, Birstall, in the county of York, under the name of BROWN AND HALL, oil and soap merchants. First and final dividend of 1s. 1d. per £, payable June 2, Official Receiver's office, 12, Duke Street, Bradford.

New Companies Registered

W. GRAHAM-YOOLL AND CO., LTD., 63, Commercial Street, Leith. Import and export oil merchants, wholesale drysalters, colour and varnish merchants, etc. Nominal capital, £4,000 in 3,000 ordinary and 1,000 deferred shares of £1 each.

LAWS, STACEY AND DYMOND, LTD., Lion Works, Sydney Road, Watford, Herts. Manufacturing and analytical chemists, druggists and perfumers. Nominal capital, £5,000 in £1 shares.

LIMESTONE PRODUCTS, LTD., Pantyrodin House, Llandebie, Carmarthenshire. Lime makers, coke and gas makers, dealers in lime, silica, clay, tar, pitch, etc. Nominal capital, £50,000 in £1 shares (20,000 6 per cent. cum. pref. and 30,000 ord.).

PEARSON'S (YORK), LTD., 51, Coney Street, York. Drysalters, manufacturing chemists, etc. Nominal capital, £5,000 in £1 shares.

RADIUM (BROADHEATH), LTD., Radium Works, Broadheath. Manufacturers and producers of and dealers in paint, varnish, creosote, tar, oil, grease, soap, glycerine, glue, etc. Nominal capital, £25,000 in £1 shares.

E. AND F. RICHARDSON, LTD., Duroline Works, Batsworth Road, Mitcham, Surrey. Varnish, enamel and paint manufacturers, oil boilers and refiners, etc. Nominal capital, £5,000 in £1 shares.

WALLINGFORDS, LTD., Central House, 75, New Street, Birmingham. Manufacturers, importers, and exporters of and dealers in surgical and scientific apparatus, chemicals, drugs, etc. Nominal capital, £100 in 1s. shares.

R. F. WHITE AND CO., LTD, 3, Gray's Inn Place, London, W.C.1. Soap boilers and candle makers; manufacturers of starch, water softeners, soda, etc. Nominal capital, £500 in £1 shares.

Sulphuric Acid in India

A CORRESPONDENT of the *Times Trade Supplement* states that Dr. E. R. Watson has published the results of his investigation into India's sulphuric acid resources. He finds that the manufacture of sulphuric acid in India is feasible and profitable. At present all the acid produced in India is obtained from imported materials. India is deficient in pyrites and native sulphur, but she has large deposits of sulphates. Large quantities of the sulphates of soda are found in the earth salts of Behar, which sell at Rs. 1-6-0 per maund. Dr. Watson's experiments incline him to favour electrolysis of sulphate of soda solutions. The liquor drawn from the anode compartment will contain bisulphate of soda, together with unchanged sulphate of soda. After separating unchanged sulphate by crystallisation, Dr. Watson recommends the distilling out of the acid.

As regards cost of production, it is not possible to give exact figures until the process has been worked on a fairly large scale, but if the cost of the sulphate of soda required for the process and the electricity consumed is compared with the market value of the sulphuric acid and caustic soda produced a rough idea can be obtained as to whether the process is likely to be profitable. This rough calculation shows a large margin for cost of plant, cost of subsequent operations, such as concentration and distillation, and profit. The most important item is electric current. If this taken at 1 anna per unit, we have :—

COST OF MATERIALS AND CURRENT.

144 tons of sulphate of soda at Rs. 1-6a. per maund ..	Rs. 5,545
235,400 units of electricity at 1 anna per unit	Rs. 14,710
Total	Rs. 20,255

MARKET VALUE OF PRODUCTS.

112 tons of 71 per cent. caustic soda at Rs. 400 per ton	Rs. 45,070
122 tons of 80 per cent. sulphuric acid at Rs. 170 per ton	Rs. 20,820
Total	Rs. 65,890

For large installations the cost of electricity might be less than 1 anna per unit, especially if hydro-electric power were available or if the process were worked in conjunction with other large undertakings—*e.g.*, iron and steel works—producing power economically. For small installations the cost of electricity might be higher. As a set-off, the small installation would be located where it would only have to compete with imported products on which high railway freights are charged